AQUAZONE™
50HQL072-120
50VQL080-300
Water Source Heat Pump Units

Installation, Start-Up, and Service Instructions

CONTENTS

IMPORTANT: Read the entire instruction manual before starting installation.

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Book 1 4 Tab 5a 5a Catalog No. 04-53500034-01 Printed in U.S.A. Form 50H,V-10SI

7-07 Replaces: 50H,V-9SI

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and the National Electrical Code (NEC) for special installation requirements.

Understand the signal words — DANGER, WARNING, and CAUTION. DANGER identifies the most serious hazards which will result in severe personal injury or death. WARNING signifies hazards that could result in personal injury or death. CAUTION is used to identify unsafe practices, which would result in minor personal injury or product and property damage.

Recognize safety information. This is the safety-alert symbol (⚠). When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

⚠ WARNING

Electrical shock can cause personal injury or death. Before installing or servicing system, always turn off main power to system. There may be more than one disconnect switch. Turn off accessory heater power if applicable.

GENERAL

This Installation and Start-Up Instructions literature is for Aquazone™ water source heat pump systems.

Water source heat pumps (WSHPs) are single-package horizontally and vertically mounted units with electronic controls designed for year-round cooling and heating.

IMPORTANT: The installation of water source heat pump units and all associated components, parts, and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

INSTALLATION

Step 1 — Check Jobsite — Installation, operation and maintenance instructions are provided with each unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check out the system before operation. Complete the inspections and instructions listed below to prepare a unit for installation. See Tables 1 and 2 for unit physical data.

HORIZONTAL UNITS (50HQL) — Horizontal units are designed for indoor installation only. Be sure to allow adequate space around the unit for servicing. See Fig. 1A and 1B for overall unit dimensions. Refer to Fig. 2 for an example of a typical horizontal installation.

VERTICAL UNITS (50VQL) — Vertical units are designed for indoor installation only. While vertical units are typically installed in a floor-level closet or a small mechanical room, the unit access guidelines for these units are very similar to those described for horizontal units. Refer to Fig. 3 for an example of a typical vertical installation. See Fig. 4A-4C for overall unit dimensions.

⚠ CAUTION

To avoid equipment damage, do not use these units as a source of heating or cooling during the construction process. The mechanical components and filters used in these units quickly becomes clogged with construction dirt and debris which may cause system damage.

Step 2 — Check Unit — Upon receipt of shipment at the jobsite, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the carton or crating of each unit, and inspect each unit for damage. Ensure the shipping company makes proper notation of any shortages or damage on all copies of the freight bill. Concealed damage not discovered during unloading must be reported to the shipping company within 15 days of receipt of shipment.

NOTE: It is the responsibility of the purchaser to file all necessary claims with the shipping company.

1. Verify unit is correct model for entering water temperature of job.
2. Be sure that the location chosen for unit installation provides ambient temperatures maintained above freezing. Well water applications are especially susceptible to freezing.
3. Be sure the installation location is isolated from sleeping areas, private offices and other acoustically sensitive spaces.

   NOTE: A sound control accessory package may be used to help eliminate sound in sensitive spaces.
4. Check local codes to be sure a secondary drain pan is not required under the unit.
5. Be sure unit is mounted at a height sufficient to provide an adequate slope of the condensate lines. If an appropriate slope cannot be achieved, a field-supplied condensate pump may be required.
6. Provide sufficient space for duct connection.
7. Provide adequate clearance for filter replacement and drain pan cleaning. Do not allow piping, conduit, etc. to block filter access.
8. Provide sufficient access to allow maintenance and servicing of the fan and fan motor, compressor and coils. Removal of the entire unit from the closet should not be necessary.
9. Provide an unobstructed path to the unit within the closet or mechanical room. Space should be sufficient to allow removal of unit if necessary.
10. Provide ready access to water valves and fittings, and screwdriver access to unit side panels, discharge collar, and all electrical connections.
11. Where access to side panels is limited, pre-removal of the control box side mounting screws may be necessary for future servicing.

STORAGE — If the equipment is not needed for immediate installation upon its arrival at the jobsite, it should be left in its shipping carton and stored in a clean, dry area of the building or in a warehouse. Units must be stored in an upright position at all times. If carton stacking is necessary, stack units a maximum of 3 high. Do not remove any equipment from its shipping package until it is needed for installation.

Table 1 — Physical Data — 50HQL072-120 Units

UNIT 50HQL	072	096	120
NOMINAL CAPACITY (tons)	6	8	10
COMPRESSOR(S)*	Scroll		
WEIGHT (lb)			
Operating	540	580	660
Shipping	560	600	680
AIR COIL	Aluminum Fins, Copper Tubes		
Total Face Area (sq ft)	6.66	8.33	8.33
Tube Size (in.)	$^{3}/_{8}$	$^{3}/_{8}$	$^{3}/_{8}$
Fin Spacing (FPI)	14	14	12
Number of Rows	2	3	4
REFRIGERANT CHARGE† (oz/ckt)	56	50	80
NO. OF CIRCUITS	1	2	2
HIGH-VOLTAGE BUSHING (in.)	1$^{3}/_{8}$		
FAN			
Qty...Wheel Size (D x W) (in.)	1...12 x 11	2...10 x 10	2...11 x 10
Standard (hp)	1.5	2	2
Large (hp)	2	3	3
Range (rpm)	760-1014		
REFRIGERANT-TO-WATER HEAT EXCHANGER	Steel-Copper or Steel-Cupronickel Tube-in-Tube		
Connection (FPT) (in. ...TPI)	1$^{1}/_{4}$...11$^{1}/_{2}$		
CONDENSATE DRAIN CONNECTION — FPT (in. ...TPI)	$^{3}/_{4}$...14		
FILTER STANDARD — 1-IN. THROWAWAY			
Qty...Size (H x W) (in.)	1...20 x 18 and 2...20 x 20	2...20 x 25 and 1...20 x 18	

LEGEND

FPI — Fins per Inch
TPI — Threads per inch

*All units have grommet and spring compressor mountings, and $^{1}/_{2}$ in. and $^{7}/_{8}$ in. electrical knockouts.
†Check unit label for refrigerant type (R-22 or R-407c).

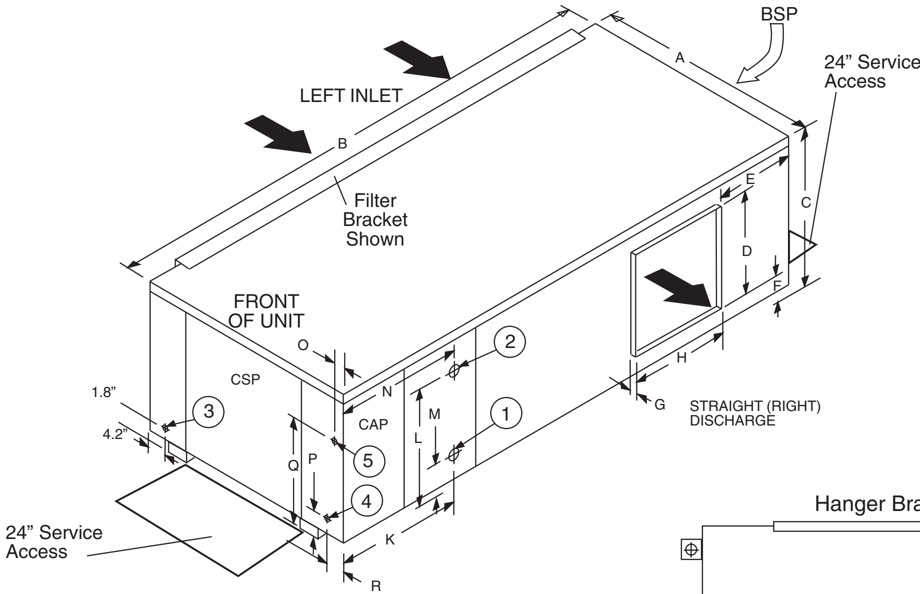
Table 2 — Physical Data — 50VQL080-300 Units

UNIT 50VQL	080	100	120	160	200	240	300
NOMINAL CAPACITY (tons)	6$^{1}/_{2}$	8$^{1}/_{2}$	10	13	17	20	25
COMPRESSOR(S) Qty...Type	1...Scroll	1...Scroll	1...Scroll	2...Scroll	2...Scroll	2...Scroll	2...Scroll
WEIGHTS (lb)							
Operating	600	685	735	1120	1265	1350	1465
Shipping	610	695	745	1145	1275	1375	1475
AIR COIL	Aluminum Fins, Copper Tubes						
Total Face Area (sq ft)	9.00			18.00			18.75
Tube Size (in.)	$^{3}/_{8}$			$^{3}/_{8}$			$^{1}/_{2}$
Fin Spacing (FPI)	14			14			15
Number of Rows	2	3	3	2	2	3	4
REFRIGERANT CHARGE R-22 (oz/ckt)	110	120	128	110	120	128	192
NO. OF CIRCUITS	1	1	1	1	2	2	2
HIGH-VOLTAGE BUSHING (in.)	1$^{3}/_{8}$-1$^{3}/_{4}$						2
FAN							
Qty...Wheel Size (D x W) (in.)	1...12 x 9	1...15 x 15	1...15 x 15	2...12 x 9	2...15 x 15	2...15 x 15	2...15 x 15
Standard Motor (hp)	1.5	1.5	2.0	3.0	1.5	2.0	3.0
Large Motor (hp)	2.0	2.0	3.0	N/A	2.0	3.0	N/A
Range (rpm)	768-982	724-925	768-982	768-982	724-925	768-982	896-1110
REFRIGERANT-TO-WATER HEAT EXCHANGER	Steel-Copper or Steel-Cupronickel Tube-in-Tube						
Water Connection (FPT) (in. ...TPI)	1$^{1}/_{2}$...11$^{1}/_{2}$	1$^{1}/_{2}$...11$^{1}/_{2}$	1$^{1}/_{2}$...11$^{1}/_{2}$	1$^{1}/_{2}$...11$^{1}/_{2}$	1$^{1}/_{2}$...11$^{1}/_{2}$	1$^{1}/_{2}$...11$^{1}/_{2}$	1$^{1}/_{2}$...11$^{1}/_{2}$
CONDENSATE DRAIN CONNECTION (FPT) (in. ...TPI)	1...11$^{1}/_{2}$						
FILTER	1-in. Throwaway*						
Qty...Size (H x W) (in.)	2...25 x 25			4...25 x 25			

LEGEND

FPI — Fins Per Inch
TPI — Threads Per Inch

*Two-in. filter available as a field-installed accessory.



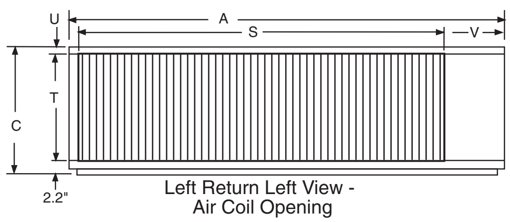
CONNECTIONS

1	Water Outlet	1 1/4″ FPT
2	Water Inlet	1 1/4″ FPT
3	Condensate Drain	3/4″ FPT
4	High Voltage Access	7/8″ [2.2] K.O.
5	Low Voltage Access	7/8″ [2.2] K.O.

LEGEND

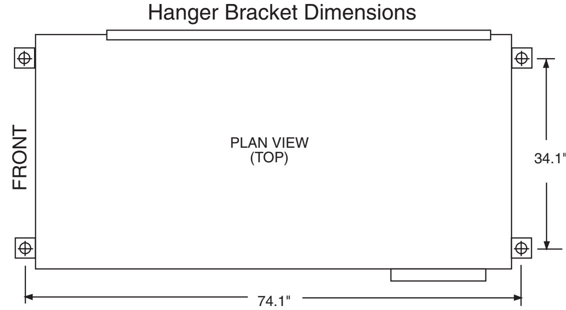
BSP — Blower Service Panel
CAP — Control Access Panel
CSP — Compressor Service Panel

NOTES:
1. All dimensions in inches.
2. Flanged filter bracket shipped with unit. Leave one end of duct collar open for filter removal.
3. All side panels are removable.
4. Available in left return, straight discharge only.
5. Condensate is 3/4 in. FPT copper.
6. Horizontal unit shipped with filter bracket only. This bracket should be removed for return duct connection.



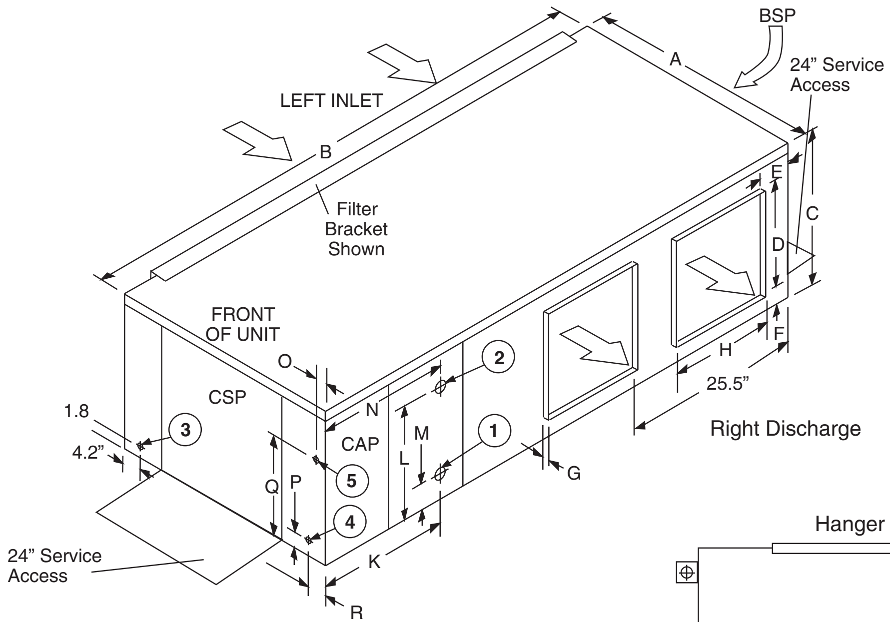
Left Return Left View -
Air Coil Opening

Hanger Bracket Dimensions



HORIZONTAL MODEL		OVERALL CABINET			DISCHARGE CONNECTIONS (Duct Flange [± 0.10 in.])					WATER CONNECTIONS				ELECTRICAL KNOCKOUTS				RETURN AIR CONNECTIONS (Using Return Air Opening)			
		A Width	**B Depth**	**C Height**	**D Supply Height**	**E**	**F**	**G**	**H Supply Depth**	**K**	**L**	**M**	**N**	**O**	**P**	**Q**	**R**	**S Return Depth**	**T Return Height**	**U**	**V**
072	**in.**	36.3	72.3	21.6	16.0	14.5	4.0	1.0	16.0	21.0	17.8	3.9	22.5	2.0	5.6	18.3	2.0	51.0	18.4	1.0	19.6

Fig. 1A — 50HQL072 Unit Dimensions



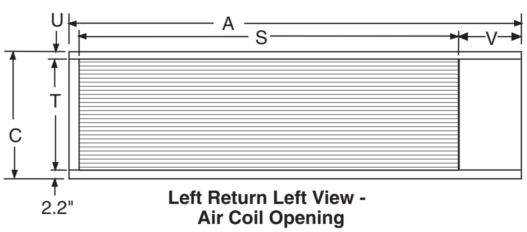
CONNECTIONS

1	Water Outlet	$1^1/_4$″ FPT
2	Water Inlet	$1^1/_4$″ FPT
3	Condensate Drain	$^3/_4$″ FPT
4	High Voltage Access	$^7/_8$″ K.O.
5	Low Voltage Access	$^7/_8$″ DIA.

LEGEND

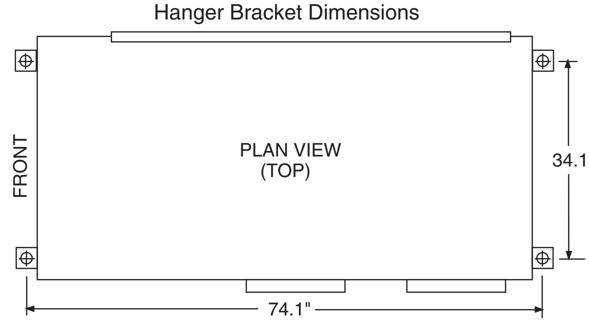
BSP — Blower Service Panel
CAP — Control Access Panel
CSP — Compressor Service Panel

NOTES:
1. All Dimensions in inches.
2. Flanged filter bracket shipped with unit. Leave one end of duct collar open for filter removal.
3. All side panels are removable.
4. Available in left return, right discharge only.
5. Condensate is $^3/_4$ in. FPT copper.
6. Horizontal unit shipped with filter bracket only. This bracket should be removed for return duct connection.



Left Return Left View - Air Coil Opening

Hanger Bracket Dimensions



UNIT 50HQL	OVERALL CABINET (in.)			DISCHARGE CONNECTIONS (in.) (Duct Flange [± 0.10 in.])					WATER CONNECTIONS (in.)				ELECTRICAL KNOCKOUTS (in.)				RETURN AIR CONNECTIONS (in.) (Using Return Air Opening)			
	A Width	B Depth	C Height	D Supply Height	E	F	G	H Supply Depth	K	L	M	N	O	P	Q	R	S Return Depth	T Return Height	U	V
096	36.3	72.3	21.0	13.1	2.9	3.8	1.0	15.1	20.7	18.6	3.8	22.4	2.0	5.6	18.3	2.0	63.2	18.4	1.0	7.5
120	36.3	72.3	21.0	13.1	2.9	4.7	1.0	15.1	19.0	19.2	3.8	22.4	2.0	5.6	18.3	2.0	63.2	18.4	1.0	7.5

Fig. 1B — 50HQL096,120 Unit Dimensions

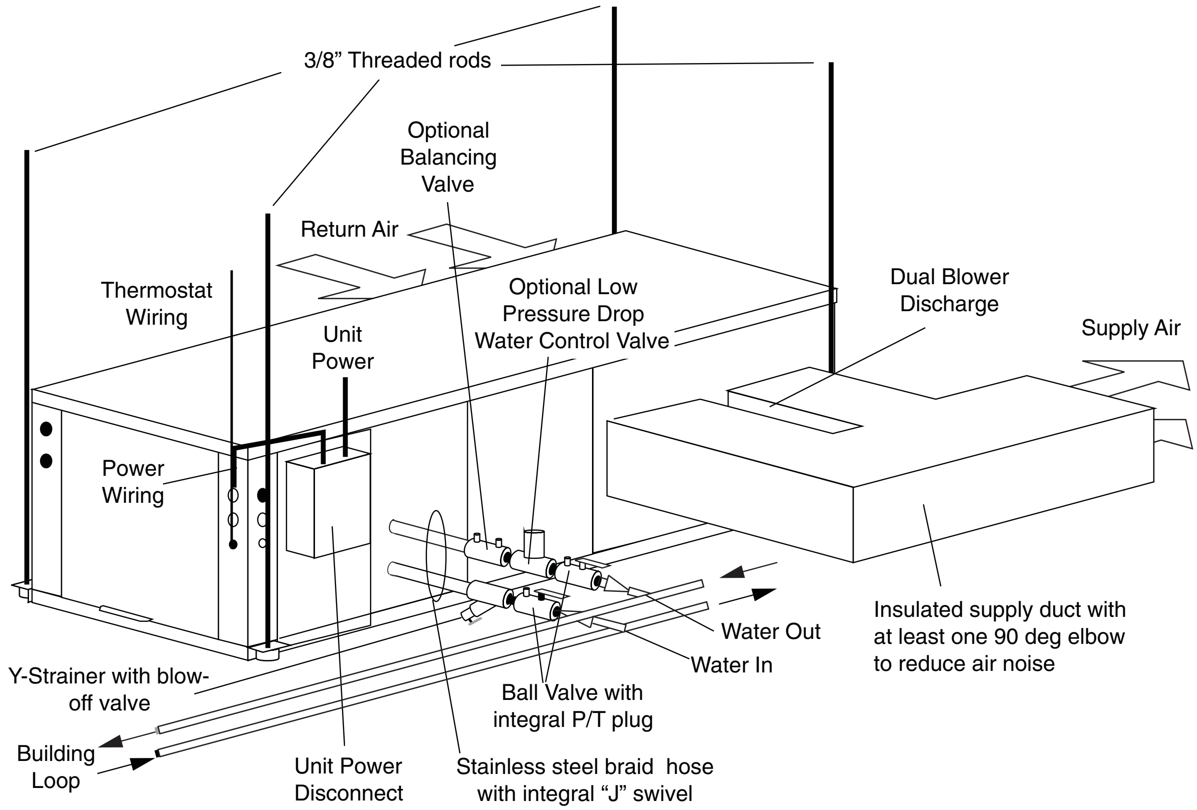


Fig. 2 — Typical Horizontal Installation — 50HQL Units

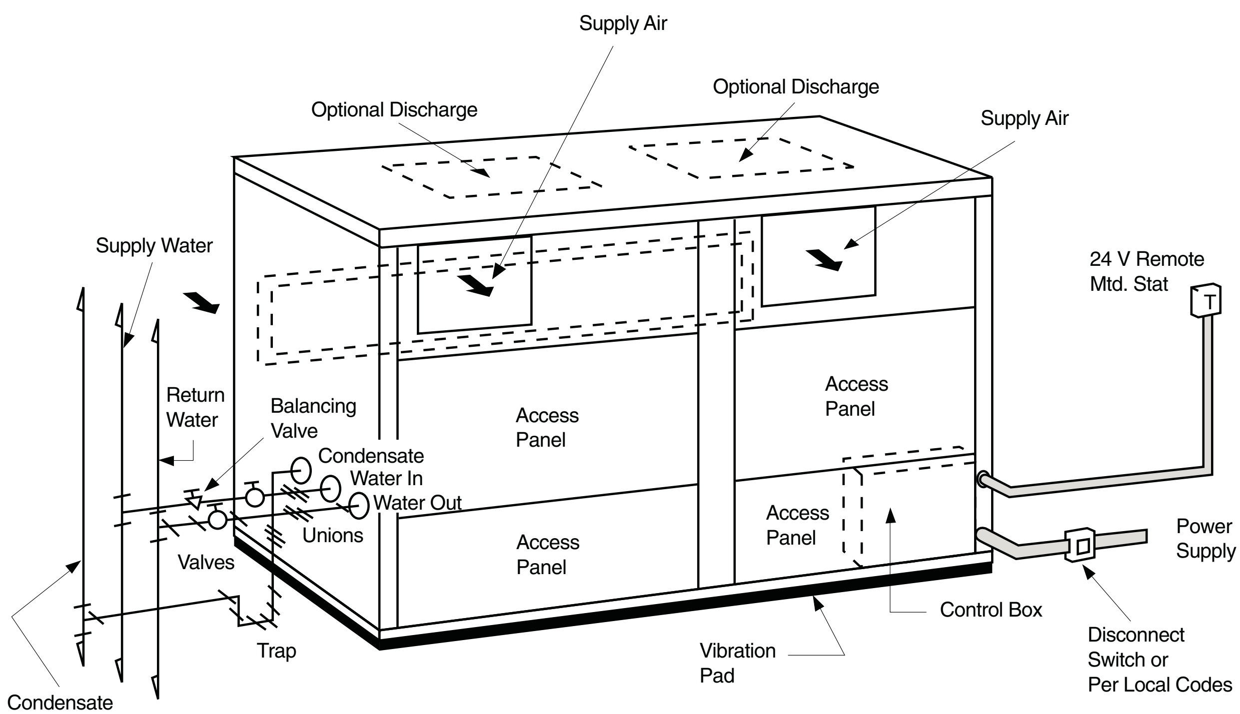
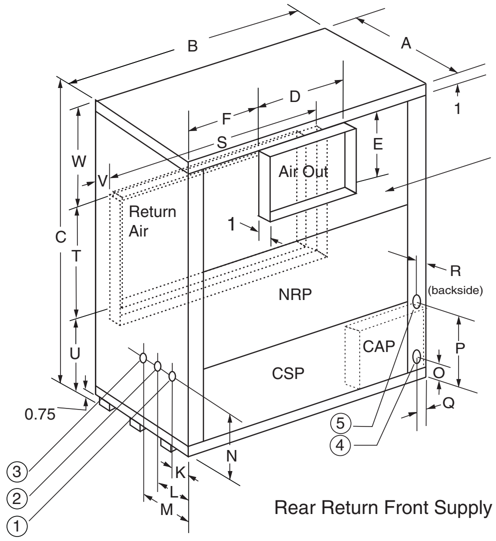
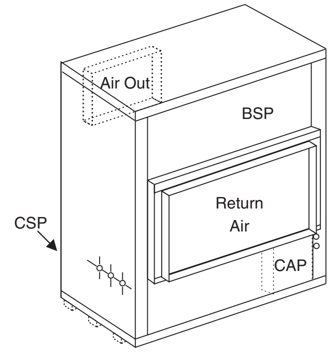


Fig. 3 — Typical Vertical Installation — 50VQL Units



Rear Return Front Supply



Front Return Rear Blow

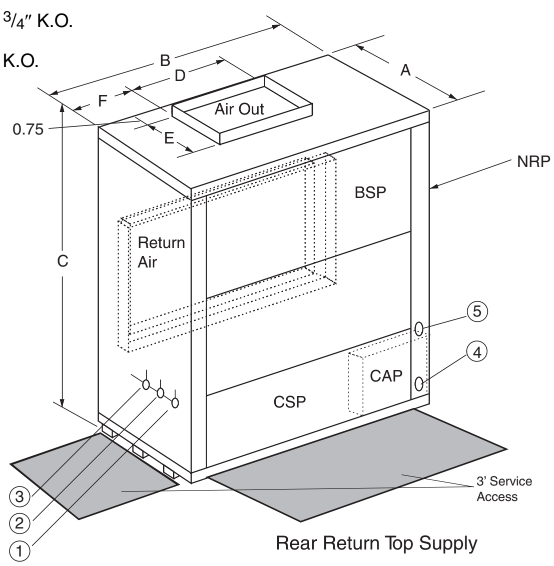
CONNECTIONS

1. Water Inlet — $1^1/_2''$ FPT
2. Water Outlet — $1^1/_2''$ FPT
3. Condensate Drain — 1″ FPT
4. High Voltage Access — $1^3/_8$ or $1^3/_4''$ K.O.
5. Low Voltage Access — $^1/_2''$ K.O.

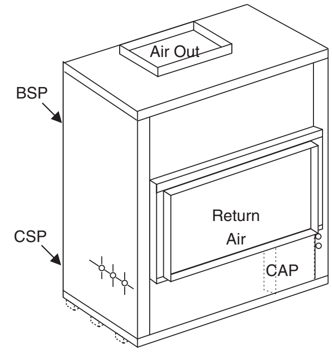
LEGEND

BSP — Blower Service Panel
CAP — Control Access Panel
CSP — Compressor Service Panel
HWR — Hot Water Reheat
NRP — Non-Removable Panel

NOTES:
1. All dimensions in inches [cm].
2. Units require 3′ [91] clearance for water connections, CAP, CSP and BSP service access.
3. All side panels are removable except those identified by NRP (Non-Removable Panel).



Rear Return Top Supply

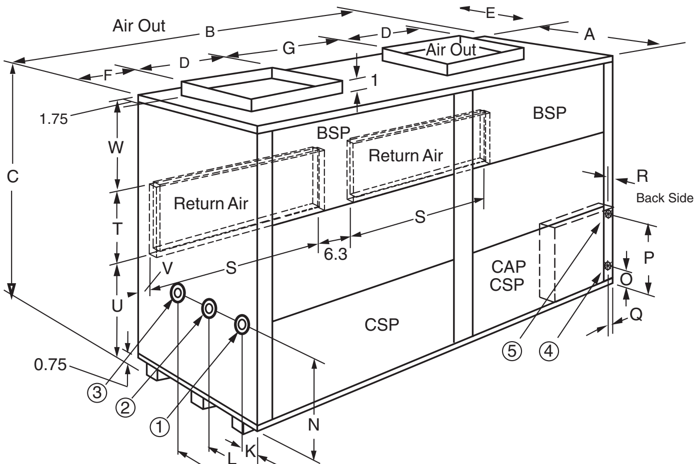


Front Return Top Blow

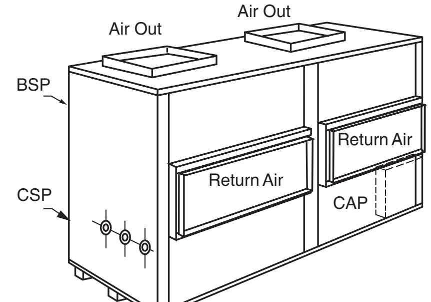
UNIT 50VQL		OVERALL CABINET			DISCHARGE CONNECTIONS (Duct Flange [± 0.10 in.])			WATER CONNECTIONS				ELECTRICAL KNOCKOUTS				RETURN AIR CONNECTIONS (Using Duct Flange)				
		A Width	B Depth	C Height	D Supply Width	E Supply Depth	F	K 1-Water Inlet	L 2-Water Outlet	M 3-Condensate	N	O	P	Q	R	S Return Depth	T Return Height	U	V	W
080,100	in.	29.0	41.0	71.5	14.7	15.8	11.2	4.0	7.4	14.5	20.5	2.1	20.6	1.0	3.1	34.8	23.4	25.4	3.1	22.6
120	in.	29.0	41.0	71.5	18.8	16.1	5.8	4.0	7.4	14.5	20.5	2.1	20.6	1.0	3.1	34.8	23.4	25.4	3.1	22.6

UNIT 50VQL WITH HWR	OVERALL CABINET (in.)			DISCHARGE CONNECTIONS (in.) (Duct Flange [± 0.10 in.])			WATER CONNECTIONS (in.)					ELECTRICAL KNOCKOUTS (in.)				RETURN AIR CONNECTIONS (in.) (Using Duct Flange)				
	A Width	B Depth	C Height	D Supply Width	E Supply Depth	F	K 1-Water Inlet	L 2-Water Outlet	M 3-Condensate Back Return	M 3-Condensate Front Return	N	O	P	Q	R	S Return Depth	T Return Height	U	V	W
080	34.0	41.0	71.0	14.5	15.8	11.2	3.0	7.5	26.5	7.4	17.8	5.8	8.5	1.0	3.1	36.2	38.2	24.9	2.4	8.6
100,120	34.0	41.0	71.0	14.5	16.2	5.8	3.0	7.5	26.5	7.4	17.8	5.8	8.5	1.0	3.1	36.2	38.2	24.9	2.4	8.6

Fig. 4A — 50VQL080-120 Unit Dimensions



Rear Return Top Supply



Front Return Top Supply

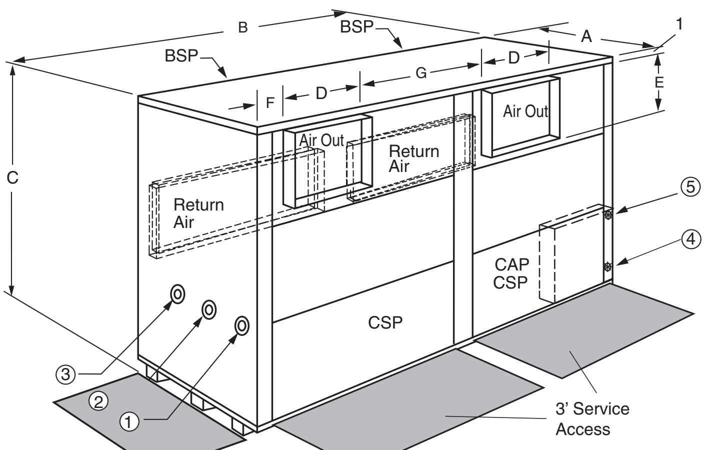
CONNECTIONS

1	Water Inlet	$1^1/_2$″ FPT
2	Water Outlet	$1^1/_2$″ FPT
3	Condensate Drain	1″ FPT
4	High Voltage Access	$1^3/_8$″ or $1^3/_4$″ K.O.
5	Low Voltage Access	$^1/_2$″ K.O.

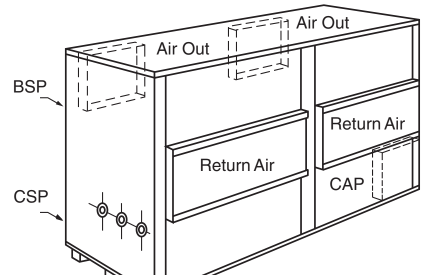
LEGEND

BSP — Blower Service Panel
CAP — Control Access Panel
CSP — Compressor Service Panel
HWR — Hot Water Reheat
NRP — Non-Removable Panel

NOTES:
1. All dimensions in inches [cm].
2. Units require 3′ [91] clearance for water connections, CAP, CSP and BSP service access.
3. All side panels are removable except those identified by NRP (Non-Removable Panel).



Rear Return Front Supply

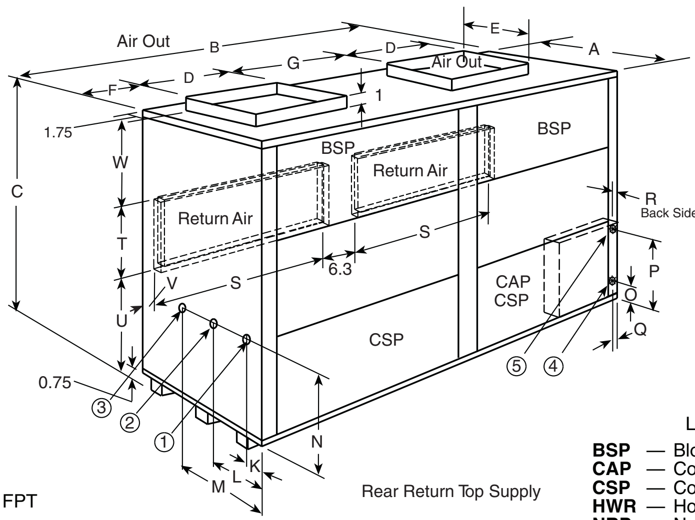


Front Return Rear Supply

UNIT 50VQL		OVERALL CABINET			DISCHARGE CONNECTIONS (Duct Flange [± 0.10 in.])				WATER CONNECTIONS				ELECTRICAL KNOCKOUTS				RETURN AIR CONNECTIONS (Using Duct Flange)				
		A Width	B Depth	C Height	D Supply Width	E Supply Depth	F	G	K 1-Water Inlet	L 2-Water Outlet	M 3-Cond-ensate	N	O	P	Q	R	S Return Depth	T Return Height	U	V	W
160	in.	29.0	82.0	71.5	14.7	15.8	19.4	13.8	4.0	7.4	14.5	20.5	2.1	20.6	1.0	3.1	34.8	23.4	25.4	3.1	22.6
200,240	in.	29.0	82.0	71.5	18.8	16.1	5.8	22.3	4.0	7.4	14.5	20.5	2.1	20.6	1.0	3.1	34.8	23.4	25.4	3.1	22.6

UNIT 50VQL WITH HWR	OVERALL CABINET (in.)			DISCHARGE CONNECTIONS (in.) (Duct Flange [± 0.10 in.])				WATER CONNECTIONS (in.)					ELECTRICAL KNOCKOUTS (in.)				RETURN AIR CONNECTIONS (in.) (Using Duct Flange)				
	A Width	B Depth	C Height	D Supply Width	E Supply Depth	F	G	K 1-Water Inlet	L 2-Water Outlet	M 3-Condensate Back Return	M 3-Condensate Front Return	N	O	P	Q	R	S Return Depth	T Return Height	U	V	W
160	34.0	82.0	71.0	14.5	15.8	19.5	13.8	3.0	7.5	26.5	7.4	17.8	5.8	8.5	1.0	3.1	36.2	38.2	24.9	2.4	8.6
200,240	34.0	82.0	71.0	19.0	16.2	5.8	22.0	3.0	7.5	26.5	7.4	17.8	5.8	8.5	1.0	3.1	36.2	38.2	24.9	2.4	8.6

Fig. 4B — 50VQL160-240 Unit Dimensions



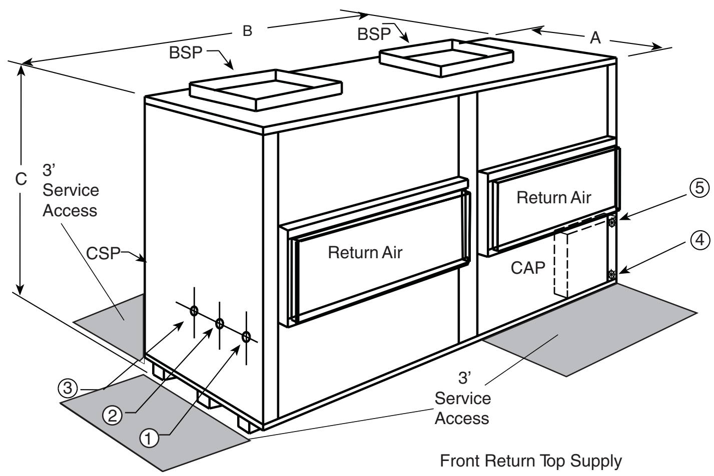
CONNECTIONS

1	Water Inlet	$1^1/_2''$ FPT
2	Water Outlet	$1^1/_2''$ FPT
3	Condensate Drain	$1''$ FPT
4	High Voltage Access	$1^3/_8''$ or $1^3/_4''$ K.O.
5	Low Voltage Access	$^1/_2''$ K.O.

LEGEND

BSP — Blower Service Panel
CAP — Control Access Panel
CSP — Compressor Service Panel
HWR — Hot Water Reheat
NRP — Non-Removable Panel

NOTES:
1. All dimensions in inches [cm].
2. Units require 3′ [91] clearance for water connections, CAP, CSP and BSP service access.
3. All side panels are removable except those identified by NRP (Non-Removable Panel).



UNIT 50VQL		OVERALL CABINET			DISCHARGE CONNECTIONS (Duct Flange [± 0.10 in.])				WATER CONNECTIONS				ELECTRICAL KNOCKOUTS				RETURN AIR CONNECTIONS (Using Duct Flange)				
		A Width	B Depth	C Height	D Supply Width	E Supply Depth	F	G	K 1-Water Inlet	L 2-Water Outlet	M 3-Condensate	N	O	P	Q	R	S Return Depth	T Return Height	U	V	W
300	in.	29.0	82.0	71.5	18.8	16.1	5.8	22.1	4.0	7.4	14.5	20.5	2.1	20.6	1.0	3.1	34.8	23.4	25.4	3.1	22.6

UNIT 50VQL WITH HWR	OVERALL CABINET (in.)			DISCHARGE CONNECTIONS (in.) (Duct Flange [± 0.10 in.])				WATER CONNECTIONS (in.)					ELECTRICAL KNOCKOUTS (in.)				RETURN AIR CONNECTIONS (in.) (Using Duct Flange)				
	A Width	B Depth	C Height	D Supply Width	E Supply Depth	F	G	K 1-Water Inlet	L 2-Water Outlet	M 3-Condensate Back Return	M 3-Condensate Front Return	N	O	P	Q	R	S Return Depth	T Return Height	U	V	W
300	34.0	82.0	71.0	19.0	16.2	5.8	22.0	3.0	7.5	26.5	7.4	17.8	5.8	8.5	1.0	3.1	36.2	38.2	24.9	2.4	8.6

Fig. 4C — 50VQL300 Unit Dimensions

PROTECTION — Once the units are properly positioned on the jobsite, they must be covered with either a shipping carton, vinyl film, or an equivalent protective covering. Open ends of pipes stored on the jobsite must be capped. This precaution is especially important in areas where painting, plastering, or spraying of fireproof material, etc. is not yet complete. Foreign material that is allowed to accumulate within the units can prevent proper start-up and necessitate costly clean-up operations.

Before installing any of the system components, be sure to examine each pipe, fitting, and valve, and remove any dirt or foreign material found in or on these components.

⚠ CAUTION

DO NOT store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life. Always move units in an upright position. Tilting units on their sides may cause equipment damage.

INSPECT UNIT — To prepare the unit for installation, complete the procedures listed below:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Do not remove the packaging until the unit is ready for installation.
3. Verify that the unit's refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
4. Inspect all electrical connections. Be sure connections are clean and tight at their terminations.
5. Loosen compressor bolts until the compressor rides freely on springs. Remove shipping restraints.
6. Remove the four $^1/_4$ in. shipping bolts from compressor support plate (two bolts on each side) to maximize vibration and sound alternation.

⚠ CAUTION

Failure to remove shipping brackets from spring-mounted compressors will cause excessive noise and could cause component failure due to added vibration.

7. Remove any blower support cardboard from inlet of the blower.
8. Locate and verify any accessory kit located in compressor and/or blower section.
9. Remove any access panel screws that may be difficult to remove once unit is installed.

Step 3 — Location of Unit — The following guidelines should be considered when choosing a location for a WSHP:

- Units are for indoor use only.
- Locate in areas where ambient temperatures are between 40 F and 100 F and relative humidity is no greater than 75%.
- Provide sufficient space for water, electrical and duct connections.
- Locate unit in an area that allows for easy access and removal of filter and access panels.
- Allow enough space for service personnel to perform maintenance.
- Provisions must be made for return air to freely enter the space if unit needs to be installed in a confined area such as a closet.

NOTE: Correct placement of the horizontal unit can play an important part in minimizing sound problems. Since ductwork is normally applied to these units, the unit can be placed so that the principal sound emission is outside the occupied space in sound-critical applications. A fire damper may be required by the local code if a fire wall is penetrated.

Step 4 — Mounting the Unit

HORIZONTAL UNITS (50HQL) — Horizontal units should be mounted using the factory-installed hangers. Proper attachment of hanging rods to building structure is critical for safety. See Fig. 2. Rod attachments must be able to support the weight of the unit. See Table 1 for unit operating weights.

VERTICAL UNITS (50VQL) — Vertical units are available in rear or front return air configurations.

Sound minimization is achieved by enclosing the unit within a small mechanical room or a closet. Additional measures for sound control include the following:

1. Mount the unit so that the return air inlet is 90 degrees to the return air grille. Install a sound baffle to reduce line-of-sight sound transmitted through return air grilles.
2. Mount the unit on a rubber or neoprene pad to minimize vibration transmission to the building structure. Extend the pad beyond all four edges of the unit.

NOTE: Some codes require the use of a secondary drain pan under vertical units. Check local codes for more information.

Step 5 — Duct System — The duct system should be sized to handle the design airflow quietly.

NOTE: Depending on the unit, the fan wheel may have a shipping support installed at the factory. This must be removed before operating unit.

SOUND ATTENUATION — To eliminate the transfer of vibration to the duct system, a flexible connector is recommended for both discharge and return air duct connections on metal duct systems. The supply and return plenums should include internal duct liner of fiberglass or be made of duct board construction to maximize sound attenuation of the blower. Installing the WSHP unit to uninsulated ductwork in an unconditioned space is not recommended since it will sweat and adversely affect the unit's performance.

To reduce air noise, at least one 90-degree elbow could be included in the supply and return air ducts, provided system performance is not adversely impacted. The blower speed can be also changed in the field to reduce air noise or excessive airflow, provided system performance is not adversely impacted.

EXISTING DUCT SYSTEM — If the unit is connected to existing ductwork, consider the following:

- Verify that the existing ducts have the proper capacity to handle the unit airflow. If the ductwork is too small, larger ductwork should be installed.
- Check existing ductwork for leaks and repair as necessary.

NOTE: Local codes may require ventilation air to enter the space for proper indoor air quality. Hard-duct ventilation may be required for the ventilating air supply. If hard ducted ventilation is not required, be sure that a proper air path is provided for ventilation air to unit to meet ventilation requirement of the space.

Step 6 — Condensate Drain

HORIZONTAL UNITS (50HQL) — Slope the unit toward the drain at a $^1/_4$ in. per foot pitch. See Fig. 5. If it is not possible to meet the required pitch, a condensate pump should be installed at the unit to pump condensate to building drain.

Horizontal units are not internally trapped, therefore an external trap is necessary. Each unit must be installed with its own individual trap and means to flush or blowout the condensate drain line. Do not install units with a common trap or vent. For typical condensate connections see Fig. 6.

NOTE: Never use a pipe size smaller than the connection.

VERTICAL UNITS (50VQL) — Each unit must be installed with its own individual trap, vent and means to flush or blowout the condensate drain line. Do not install units with a common trap or vent. See Fig. 6.

Consider the following:

- Units are typically installed directly above each other on successive floors with condensate drains located near the units.
- Connect the unit condensate drain connection to the building condensate drain with a 1-in. drain line.
- The horizontal run of a condensate hose is usually too short to cause drainage problems, however pitch the horizontal run of the condensate line should be at least 1 inch for every 10 feet of run in the direction of flow. Avoid low points and unpitched piping since dirt collects in low or level areas and may cause stoppage and overflow.
- Install a condensate trap at each unit with the top of the trap positioned below the unit condensate drain connection.
- Design the length of the trap (water-seal) based upon the amount of positive or negative pressure on the drain pan. As a rule, 1-in. of trap is required for each inch of negative pressure on the unit.

VENTING — A vent should be installed in the condensate line of any application which may allow dirt or air to collect in the line. Consider the following:

- Always install a vent where an application requires a long horizontal run.
- Always install a vent where large units are working against higher external static pressure and to allow proper drainage for multiple units connected to the same condensate main.
- Be sure to support the line where anticipated sagging from the condensate or when "double trapping" may occur.

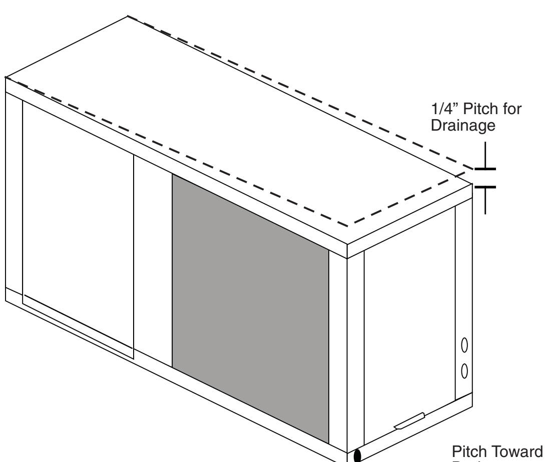


Fig. 5 — Horizontal Unit Pitch

- If condensate pump is present on unit, be sure drain connections have a check valve to prevent back flow of condensate into other units.

Step 7 — Piping Connections —

Depending on the application, there are 3 types of WSHP piping systems to choose from: water loop, ground-water and ground loop. Refer to the Carrier System Design Manual for additional information.

All WSHP units utilize low temperature soldered female pipe thread fittings for water connections to prevent annealing and out-of-round leak problems which are typically associated with high temperature brazed connections. Refer to Tables 1 and 2 for connection sizes. When making piping connections, consider the following:

- A backup wrench must be used when making screw connections to unit to prevent internal damage to piping.
- Insulation may be required on piping to avoid condensation in the case where fluid in loop piping operates at temperatures below dew point of adjacent air.
- Piping systems that contain steel pipes or fittings may be subject to galvanic corrosion. Dielectric fittings may be used to isolate the steel parts of the system to avoid galvanic corrosion.

WATER LOOP APPLICATIONS — Water loop applications usually include a number of units plumbed to a common piping system. Maintenance to any of these units can introduce air into the piping system. Therefore, air elimination equipment comprises a major portion of the mechanical room plumbing.

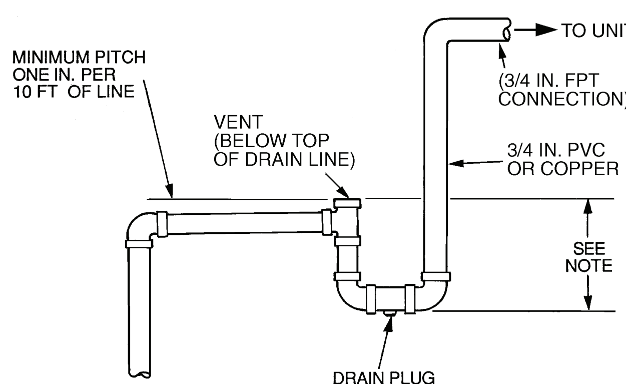
The flow rate is usually set between 2.25 and 3 gpm per ton of cooling capacity. For proper maintenance and servicing, pressure-temperature (P/T) ports are necessary for temperature and flow verification.

In addition to complying with any applicable codes, consider the following for system piping:

- Piping systems utilizing water temperatures below 50 F require $^1/_2$-in. closed cell insulation on all piping surfaces to eliminate condensation.
- All plastic to metal threaded fittings should be avoided due to the potential to leak. Use a flange fitted substitute.
- Teflon tape thread sealant is recommended to minimize internal fouling of the heat exchanger.
- Use backup wrench. Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- The piping system should be flushed prior to operation to remove dirt and foreign materials from the system.

GROUND-LOOP APPLICATIONS — Temperatures between 25 and 110 F and a cooling capacity of 2.25 to 3 gpm of flow per ton are recommended. In addition to complying with any applicable codes, consider the following for system piping:

- Piping materials should be limited to only polyethylene fusion in the buried sections of the loop.



NOTE: Trap should be deep enough to offset maximum unit static difference.

Fig. 6 — Trap Condensate Drain

- Galvanized or steel fittings should not be used at any time due to corrosion.
- All plastic to metal threaded fittings should be avoided due to the potential to leak. Use a flange fitted substitute.
- Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Pressure-temperature (P/T) plugs should be used to measure flow of pressure drop.

GROUND-WATER APPLICATIONS — Typical ground-water piping is shown in Fig. 7. In addition to complying with any applicable codes, consider the following for system piping:

- Install shut-off valves for servicing.
- Install pressure-temperature plugs to measure flow and temperature.
- Boiler drains and other valves should be connected using a "T" connector to allow acid flushing for the heat exchanger.
- Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Use PVC SCH80 or copper piping material.

NOTE: PVC SCH40 should *not* be used due to system high pressure and temperature extremes.

Water Supply and Quantity — Check water supply. Water supply should be plentiful and of good quality. See Table 3 for water quality guidelines.

IMPORTANT: Failure to comply with the above required water quality and quantity limitations and the closed-system application design requirements may cause damage to the tube-in-tube heat exchanger that is not the responsibility of the manufacturer.

In all applications, the quality of the water circulated through the heat exchanger must fall within the ranges listed in the Water Quality Guidelines table. Consult a local water treatment firm, independent testing facility, or local water authority for specific recommendations to maintain water quality within the published limits.

Step 8 — Field Power Supply Wiring

⚠ WARNING

To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

⚠ CAUTION

Use only copper conductors for field-installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

All field-installed wiring, including the electrical ground, MUST comply with the National Electrical Code (NEC) as well as applicable local codes. In addition, all field wiring must conform to the Class II temperature limitations described in the NEC.

Refer to unit wiring diagrams Fig. 8A-11B for fuse sizes and a schematic of the field connections which must be made by the installing (or electrical) contractor.

Consult the unit wiring diagram located on the inside of the compressor access panel to ensure proper electrical hookup. The installing (or electrical) contractor must make the field connections when using field-supplied disconnect.

Operating voltage must be the same voltage and phase as shown in Electrical Data shown in Tables 4 and 5.

Make all final electrical connections with a length of flexible conduit to minimize vibration and sound transmission to the building.

POWER CONNECTION — Line voltage connection is made by connecting the incoming line voltage wires to the L side of the CC terminal. See Tables 4 and 5 for correct wire and maximum overcurrent protection sizing.

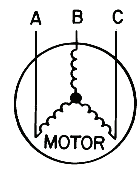
SUPPLY VOLTAGE — Operating voltage to unit must be within voltage range indicated on unit nameplate.

On 3-phase units, voltages under load between phases must be balanced within 2%. Use the following formula to determine the percentage voltage imbalance:

% Voltage Imbalance

$$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60.



AB = 452 volts
BC = 464 volts
AC = 455 volts

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3}$$

$$= \frac{1371}{3}$$

$$= 457$$

Determine maximum deviation from average voltage:

(AB) 457 – 452 = 5 v
(BC) 464 – 457 = 7 v
(AC) 457 – 455 = 2 v

Maximum deviation is 7 v.

Determine percent voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{7}{457}$$

$$= 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

Operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components.

NOTE: If more than 2% voltage imbalance is present, contact local electric utility.

EXTERNAL LOOP POWER CONNECTION — If the unit is to be connected to an external loop pump or flow controller, connect the pump to the loop pump terminal block PB1. The maximum power handling is 4 amps at 240 volts. The pumps will automatically cycle as required by the unit.

208-VOLT OPERATION — All 208-240 volt units are factory wired for 208 volts. The transformers may be switched to 240-volt operation (as illustrated on the wiring diagram) by switching the red (208 volt) wire with the orange (240 volt) wire at the L2 terminal.

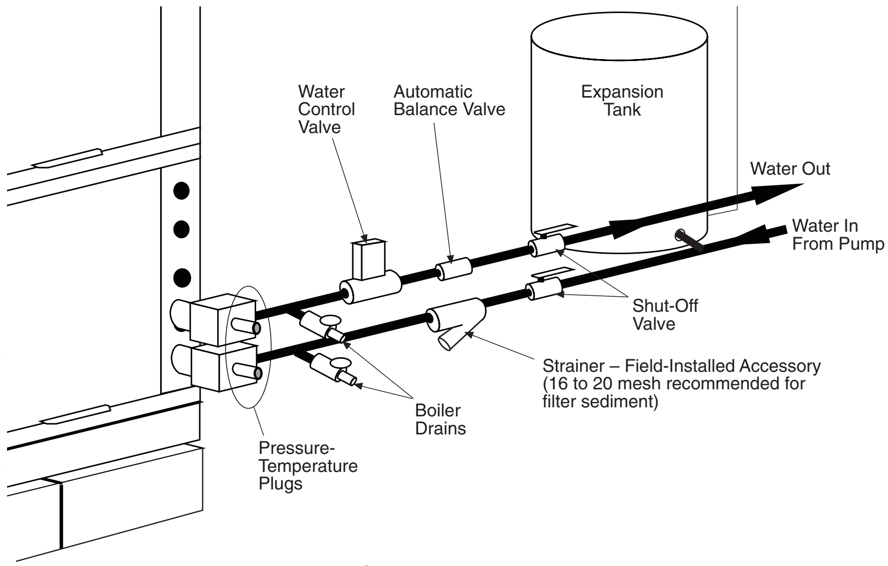


Fig. 7 — Typical Ground-Water Piping Installation

Table 3 — Water Quality Guidelines

CONDITION	HX MATERIAL*	CLOSED RECIRCULATING†	OPEN LOOP AND RECIRCULATING WELL**		
Scaling Potential — Primary Measurement Above the given limits, scaling is likely to occur. Scaling indexes should be calculated using the limits below.					
pH/Calcium Hardness Method	All	N/A	**pH < 7.5 and Ca Hardness, <100 ppm**		
Index Limits for Probable Scaling Situations (Operation outside these limits is not recommended.)					
Scaling indexes should be calculated at 150 F for direct use and HWG applications, and at 90 F for indirect HX use. A monitoring plan should be implemented.					
Ryznar Stability Index	All	N/A	**6.0 - 7.5** If >7.5 minimize steel pipe use.		
Langelier Saturation Index	All	N/A	**–0.5 to +0.5** If <–0.5 minimize steel pipe use. Based upon 150 F HWG and direct well, 85 F indirect well HX.		
Iron Fouling					
Iron Fe^{2+} (Ferrous) (Bacterial Iron Potential)	All	N/A	**<0.2 ppm (Ferrous)** If Fe^{2+} (ferrous) >0.2 ppm with pH 6 - 8, O_2<5 ppm check for iron bacteria.		
Iron Fouling	All	N/A	**<0.5 ppm of Oxygen** Above this level deposition will occur.		
Corrosion Prevention††					
pH	All	6 - 8.5 Monitor/treat as needed.	**6 - 8.5** Minimize steel pipe below 7 and no open tanks with pH <8.		
Hydrogen Sulfide (H_2S)	All	N/A	**<0.5 ppm** At H_2S>0.2 ppm, avoid use of copper and cupronickel piping or HXs. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronze or brass) cast components are okay to <0.5 ppm.		
Ammonia Ion as Hydroxide, Chloride, Nitrate and Sulfate Compounds	All	N/A	**<0.5 ppm**		
Maximum Chloride Levels			Maximum allowable at maximum water temperature.		
			50 F (10 C)	75 F (24 C)	100 F (38 C)
	Copper	N/A	<20 ppm	NR	NR
	CuproNickel	N/A	<150 ppm	NR	NR
	304 SS	N/A	<400 ppm	<250 ppm	<150 ppm
	316 SS	N/A	<1000 ppm	<550 ppm	<375 ppm
	Titanium	N/A	>1000 ppm	>550 ppm	>375 ppm
Erosion and Clogging					
Particulate Size and Erosion	All	<10 ppm of particles and a maximum velocity of 6 fps. Filtered for maximum 800 micron size.	<10 ppm (<1 ppm “sandfree” for reinjection) of particles and a maximum velocity of 6 fps. Filtered for maximum 800 micron size. Any particulate that is not removed can potentially clog components.		
Brackish	All	N/A	Use cupronickel heat exchanger when concentrations of calcium or sodium chloride are greater than 125 ppm are present. (Seawater is approximately 25,000 ppm.)		

LEGEND

HWG — Hot Water Generator
HX — Heat Exchanger
N/A — Design Limits Not Applicable Considering Recirculating Potable Water
NR — Application Not Recommended
SS — Stainless Steel

*Heat exchanger materials considered are copper, cupronickel, 304 SS (stainless steel), 316 SS, titanium.
†Closed recirculating system is identified by a closed pressurized piping system.
**Recirculating open wells should observe the open recirculating design considerations.

††If the concentration of these corrosives exceeds the maximum allowable level, then the potential for serious corrosion problems exists.
Sulfides in the water quickly oxidize when exposed to air, requiring that no agitation occur as the sample is taken. Unless tested immediately at the site, the sample will require stabilization with a few drops of one Molar zinc acetate solution, allowing accurate sulfide determination up to 24 hours after sampling. A low pH and high alkalinity cause system problems, even when both values are within ranges shown. The term pH refers to the acidity, basicity, or neutrality of the water supply. Below 7.0, the water is considered to be acidic. Above 7.0, water is considered to be basic. Neutral water contains a pH of 7.0.

NOTE: To convert ppm to grains per gallon, divide by 17. Hardness in mg/l is equivalent to ppm.

Step 9 — Field Control Wiring

THERMOSTAT CONNECTIONS — The thermostat should be wired directly to the Aquazone™ control board. See Fig. 8A-12.

WATER FREEZE PROTECTION — The Aquazone control allows the field selection of source fluid freeze protection points through jumpers. The factory setting of jumper JW3 (FP1) is set for water at 30 F. In earth loop applications, jumper JW3 should be clipped to change the setting to 13 F when using antifreeze in colder earth loop applications. See Fig. 13.

AIR COIL FREEZE PROTECTION — The air coil freeze protection jumper JW2 (FP2) is factory set for 30 F and should not need adjusting.

ACCESSORY CONNECTIONS — Terminal labeled A on the control is provided to control accessory devices such as water valves, electronic air cleaners, humidifiers, etc. This signal operates with the compressor terminal. See Fig. 14. Refer to the specific unit wiring schematic for details.

NOTE: The A terminal should *only* be used with 24 volt signals — not line voltage signals.

WATER SOLENOID VALVES — Water solenoid valves may be used on variable flow systems and ground water installations. A typical well water control valve wiring which can limit waste water in a lockout condition is shown in Fig. 14. A slow closing valve may be required to prevent water hammer. When using a slow closing valve, special wiring conditions need to be considered. The valve takes approximately 60 seconds to open (very little water will flow before 45 seconds) and it activates the compressor only after the valve is completely opened by closing its end switch. When wired as shown, the valve will have the following operating characteristics:

1. Remain open during a lockout.
2. Draw approximately 25 to 35 VA through the "Y" signal of the thermostat.

> IMPORTANT: The use of a slow-closing water solenoid valve can overheat the anticipators of electromechanical thermostats. Only use relay based electronic thermostats.

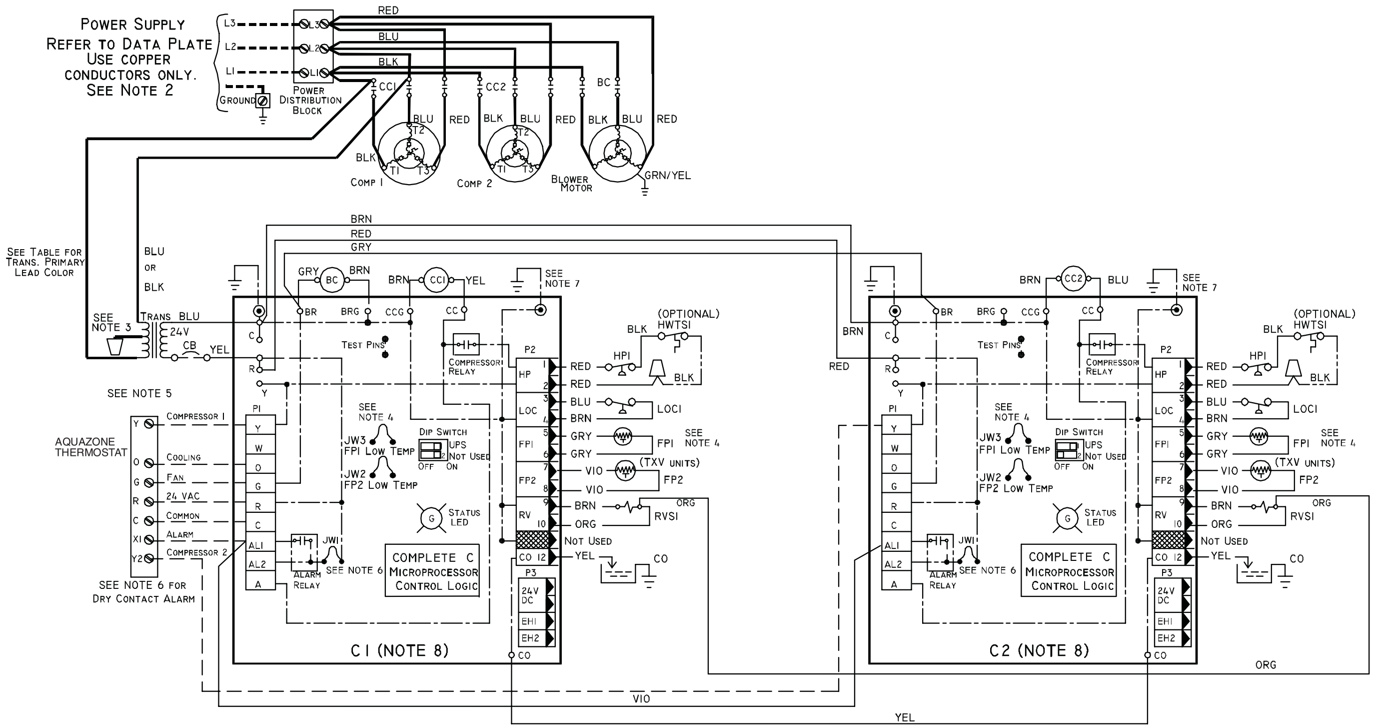
LEGEND FOR FIG. 8A-11B

AL — Alarm Relay Contacts
AL2 — Jumper Wire for Alarm
BC — Blower Contactor
CB — Circuit Breaker
CC — Compressor Contactor
CCH — Crankcase Heater
CO — Sensor, Condensate Overflow
FP1 — Sensor, Water Coil Freeze Protection
FP2 — Sensor, Air Coil Freeze Protection
HP — High-Pressure Switch
HWTS — Hot Water Temperature Sensor
JW1 or JW4 — Jumper, Alarm Mode
JW3 — Clippable Field Selection Jumper
LOC — Loss of Charge Pressure Switch
PDB — Power Distribution Block
P1 — Field Wiring Terminal Block
RVS — Reversing Valve Solenoid
TRANS — Transformer
TXV — Thermostatic Expansion Valve

*Optional wiring.

Factory Line Voltage Wiring
Factory Low Voltage Wiring
Field Line Voltage Wiring
Field Low Voltage Wiring
Printed Circuit Trace
Optional Wiring
Relay/Contactor Coil
Thermistor
Condensate Pan
Circuit Breaker
Ground

Solenoid Coil
Relay Contacts - N.O.
Relay Contacts - N.C.
Temperature Switch
Switch - Low Pressure
Switch - High Pressure
Wire Nut
Splice Cap
LED



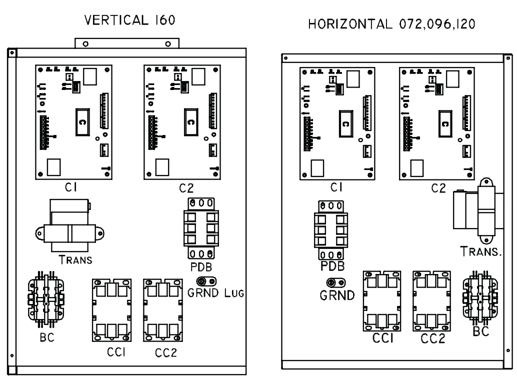


TABLE
TRANSFORMER PRIMARY
LEAD COLORS

PRIMARY VOLTAGE	PRIMARY LEAD COLOR
208	RED
230	ORG
380	VIO
420	BRN
460	BLK/RED
575	GRY

NOTES:
1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with NEC and local codes.
3. 208/230-v transformers will be connected for 208-v operation. For 230-v operation, disconnect RED lead at L1, and attach ORG lead to L1. Close open end of RED lead.
4. FPI thermistor provides freeze protection for WATER. When using ANTIFREEZE solutions, cut JW3 jumper.
5. Typical heat pump thermostat wiring shown. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be “Class 1” and voltage rating equal to or greater than unit supply voltage.
6. 24-v Alarm Signal shown. For Dry Alarm Contact, cut JW1 jumper and dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via board standoffs and screws to Control Box. (Ground available from top two standoffs as shown.)
8. Suffix 1 designates association with lead compressor. Suffix 2 with lag compressor. EXCEPTION FP2, EH1, EH2 ARE PER LEGEND.

Fig. 8A — 50HQL072-120 and 50VQL160 with Complete C Controls (Typical)

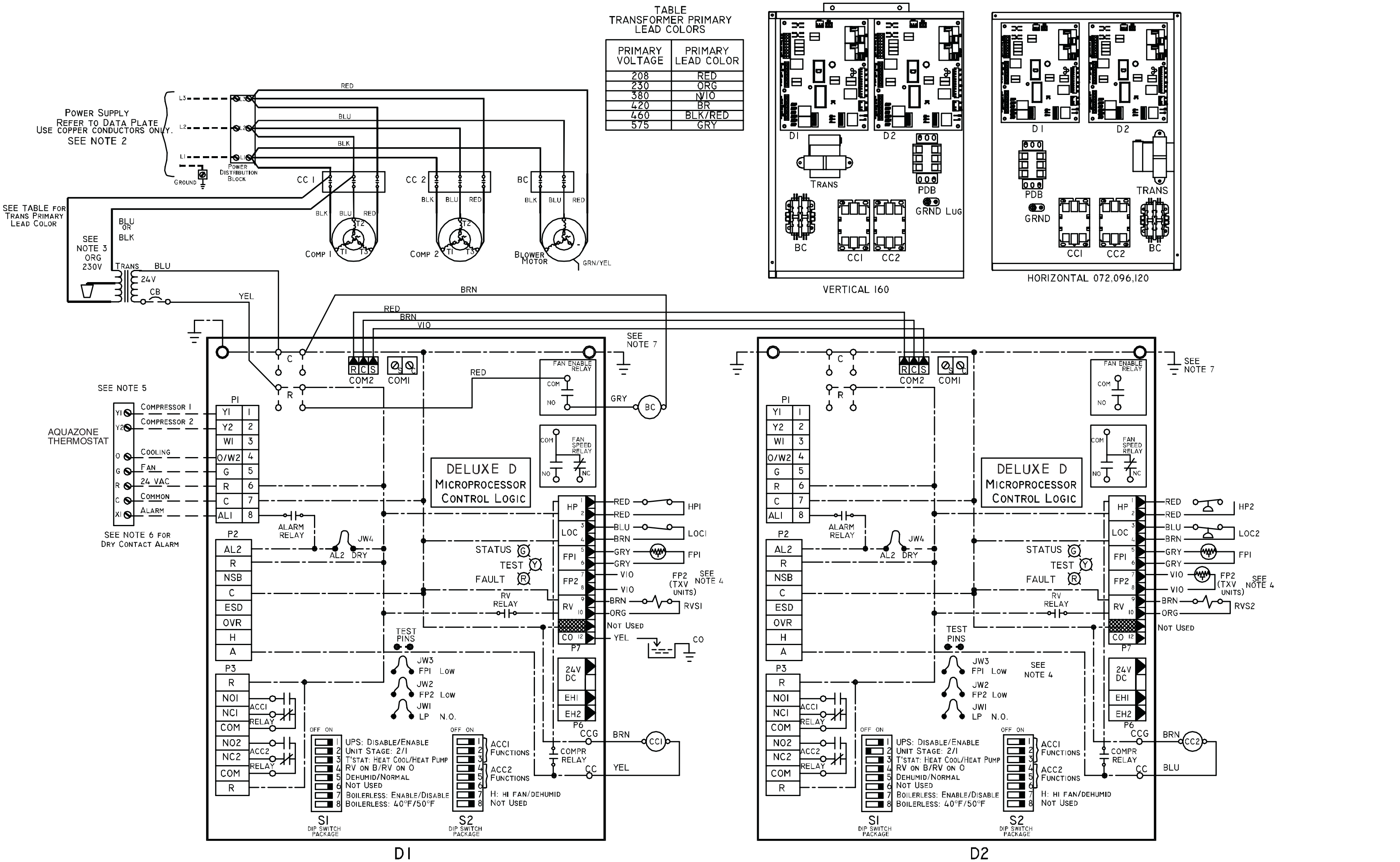


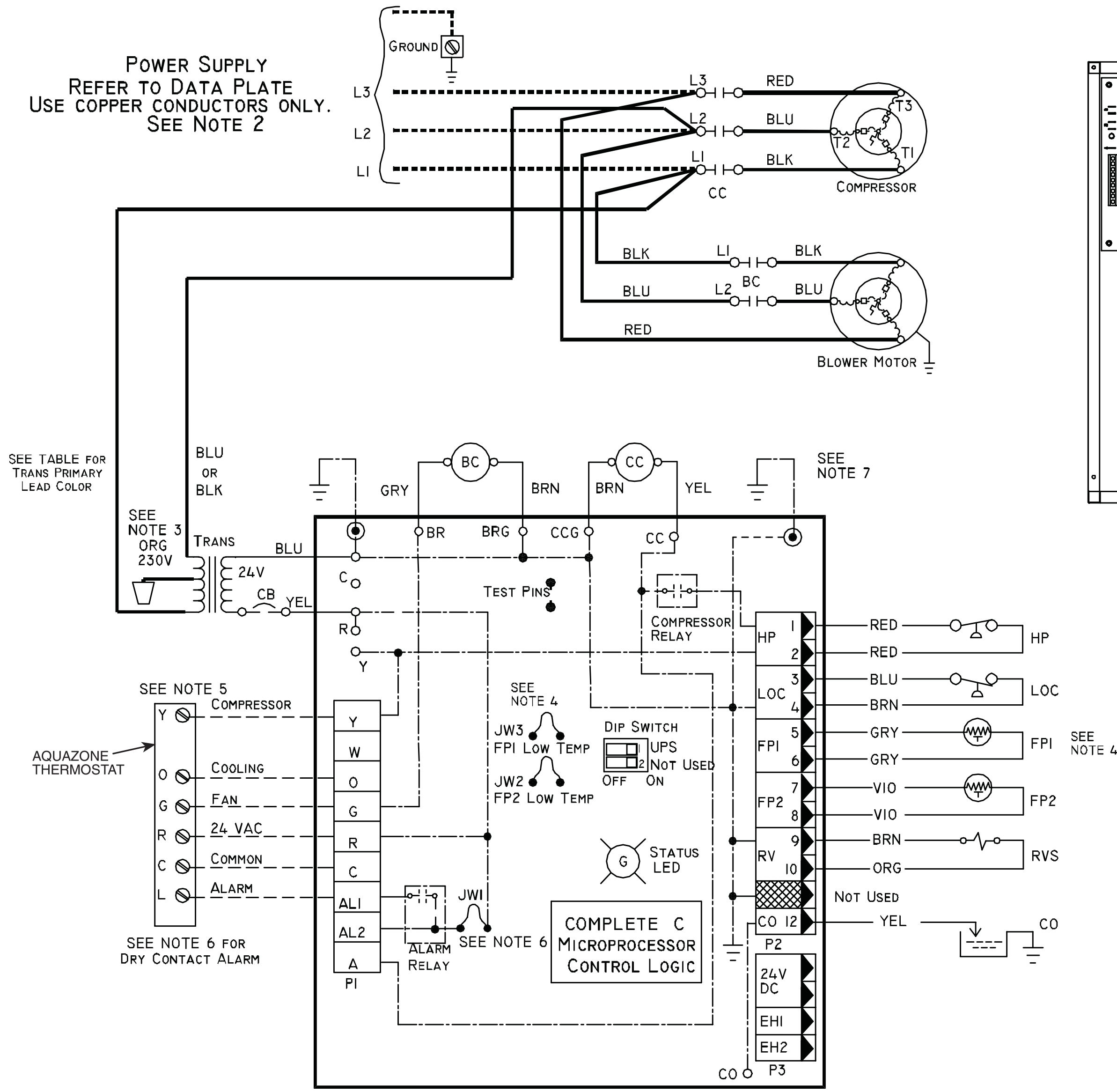
TABLE
TRANSFORMER PRIMARY
LEAD COLORS

PRIMARY VOLTAGE	PRIMARY LEAD COLOR
208	RED
230	ORG
380	VIO
420	BR
460	BLK/RED
575	GRY

NOTES:

1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with NEC and local codes.
3. 208/230-v transformer will be connected for 208-v operation. For 230-v operation, disconnect RED lead at L1, and attach ORG lead to L1. Insulate open end of RED lead. 380/420-v transformer will be connected for 380-v operation. For 420-v operation, disconnect VIO lead at L1 and attach BRN lead to L1. Insulate open end of VIO lead.
4. FP1 thermistor provides freeze protection for WATER. When using ANTIFREEZE solution, cut JW3 jumper.
5. Typical heat pump thermostat wiring shown. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be "Class 1" and voltage rating equal to or greater than unit supply voltage.
6. 24-v Alarm Signal shown. For Dry Alarm Contact, cut AL2 DRY (JW4) jumper and dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via Deluxe D board standoffs and screws to Control Box. (Ground available from top two standoffs as shown.)
8. Suffix 1 designates association with lead compressor. Suffix 2 with lag compressor. EXCEPTION FP2, EH1, EH2 ARE PER LEGEND.

Fig. 8B — 50HQL072-120 and 50VQL160 with Deluxe D Controls (Typical)



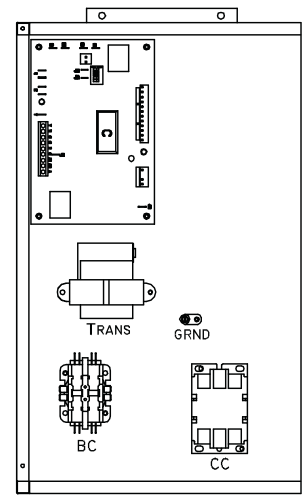
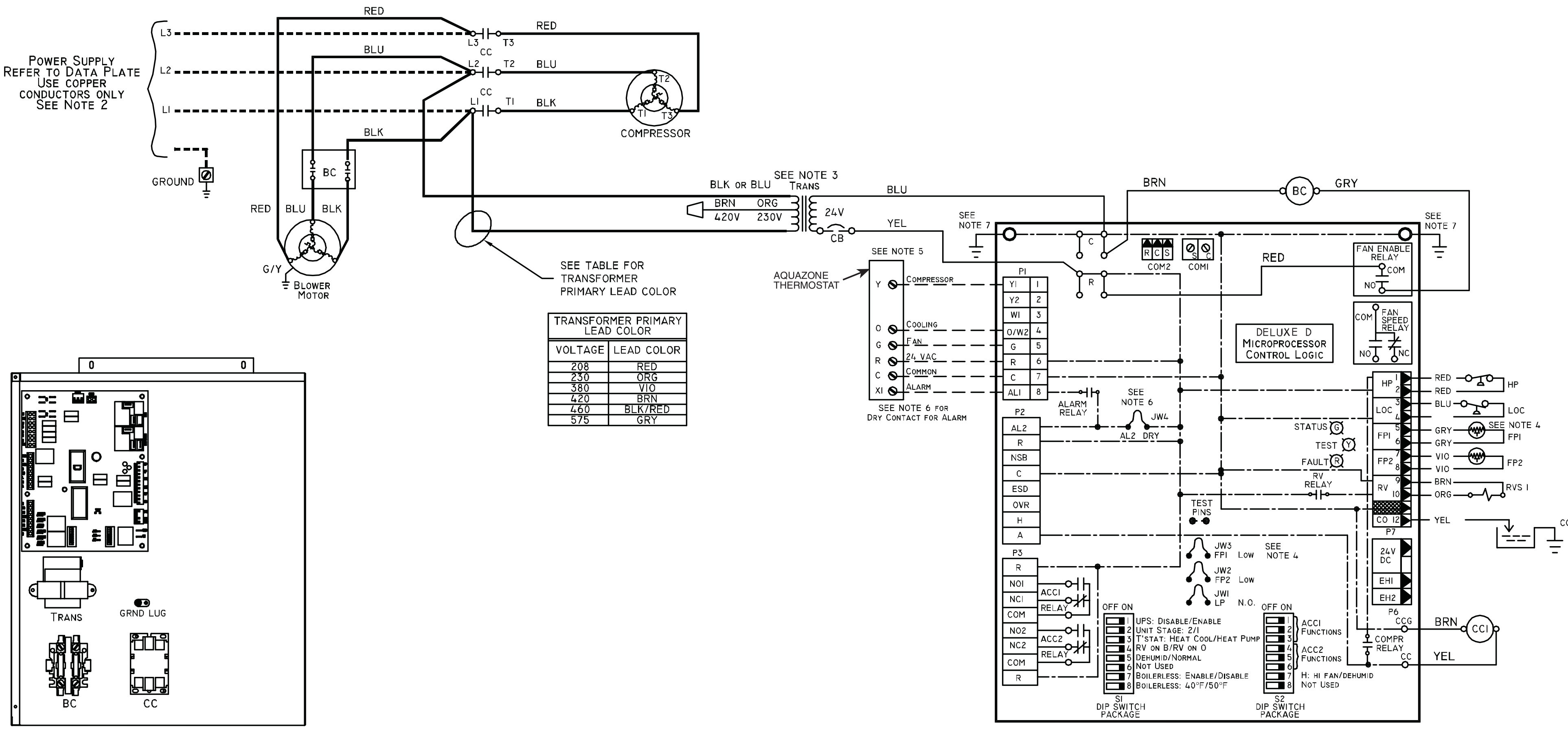


TABLE
TRANSFORMER PRIMARY
LEAD COLORS

PRIMARY VOLTAGE	PRIMARY LEAD COLOR
208	RED
230	ORG
380	VIO
420	BRN
460	BLK/RED
575	GRY

NOTES:
1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with NEC and local codes.
3. 208/230-v transformers will be connected for 208-v operation. For 230-v operation, disconnect RED lead at L1, and attach ORG lead to L1. Close open end of RED lead with insulating tape.
4. FP1 jumper provides freeze protection for WATER. When using ANTIFREEZE solutions, cut FP1 jumper.
5. Typical thermostat wiring shown. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be “Class 1” and voltage rating equal to or greater than unit supply voltage.
6. 24-v Alarm Signal shown. For Dry Alarm Contact, cut JW1 jumper and Dry Contact will be available between AL1 and AL2.
7. Transformer secondary ground via Control C board standoffs and screws to Control Box. (Ground available from top two standoffs as shown.)

Fig. 9A — 50VQL080-120 with Complete C Controls (Typical)



TRANSFORMER PRIMARY LEAD COLOR	
VOLTAGE	LEAD COLOR
208	RED
230	ORG
380	VIO
420	BRN
460	BLK/RED
575	GRY

NOTES:
1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with NEC and local codes.
3. 208/230-v transformers will be connected for 208-v operations. For 230-v operations, disconnect RED lead at L1, and attach ORG lead to L1. Close open end of RED lead.
4. FP1 thermistor provides freeze protection for WATER. When using ANTIFREEZE solutions, cut JW3 jumper.
5. Typical heat pump thermostat wiring shown. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be “Class 1” and voltage rating equal to or greater than unit supply voltage.
6. 24-v Alarm Signal shown. For Dry Alarm Contact, cut AL2 DRY (JW4) jumper and dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via Deluxe D control board standoffs and screws to Control Box. (Ground available from top two standoffs as shown.)

Fig. 9B — 50VQL080-120 with Deluxe D Controls (Typical)

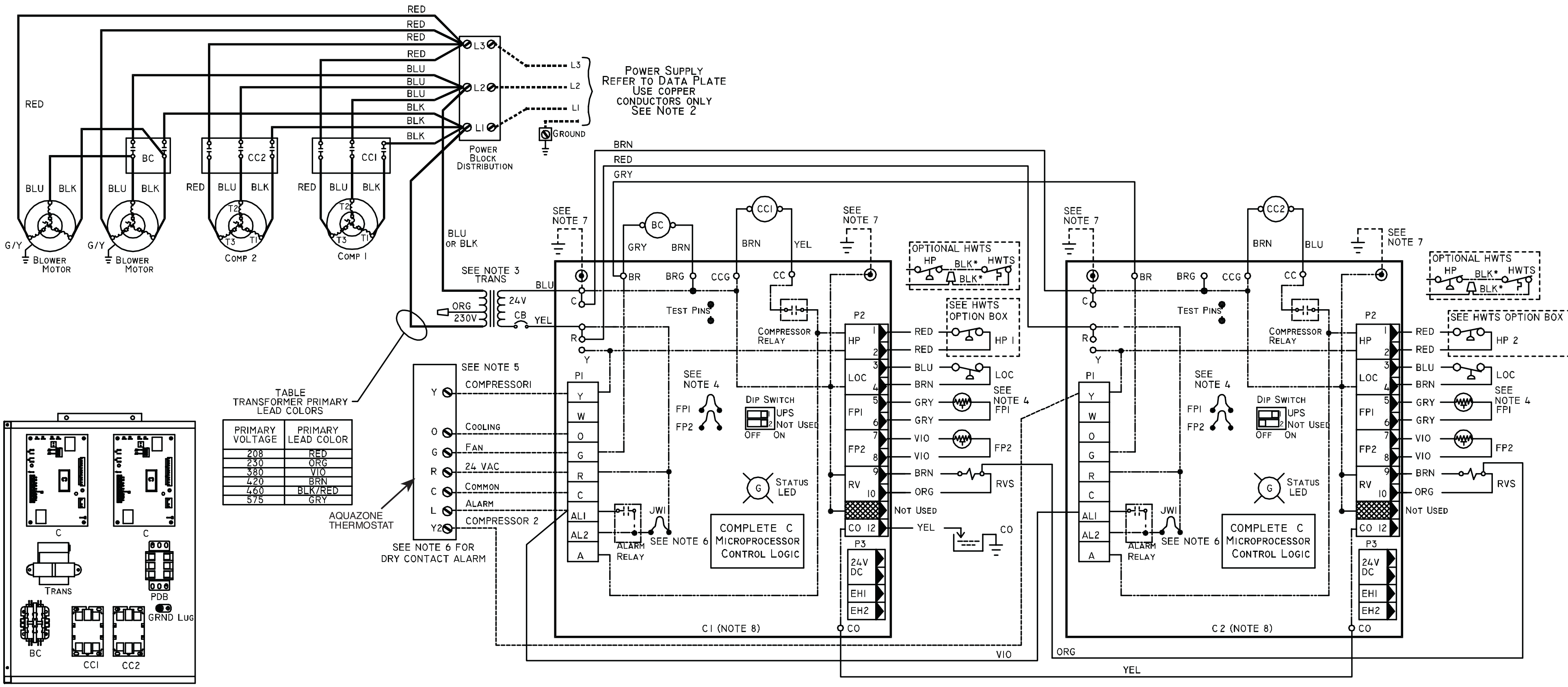
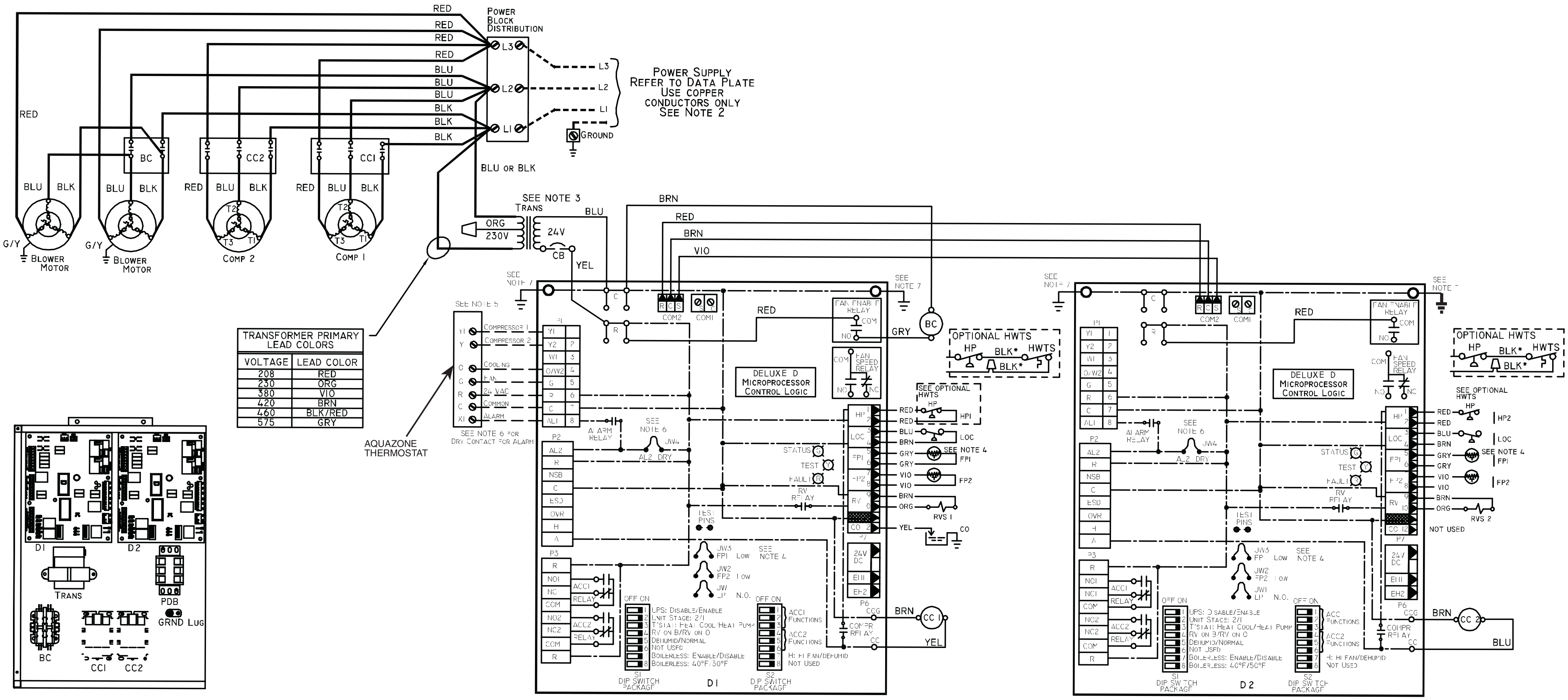


TABLE
TRANSFORMER PRIMARY
LEAD COLORS

PRIMARY VOLTAGE	PRIMARY LEAD COLOR
208	RED
230	ORG
380	VIO
420	BRN
460	BLK/RED
575	GRY

NOTES:
1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with NEC and local codes.
3. 208/230-v transformers will be connected for 208-v operation. For 230-v operation, disconnect RED lead at L1, and attach ORG lead to L1. Insulate open end of RED lead with insulating tape. 380/420-v transformers will be connected for 380-v operation.
4. FP1 thermistor provides freeze protection for WATER. When using ANTIFREEZE solution, cut FP1 jumper.
5. Typical thermostat wiring shown. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be "Class 1" and voltage rating equal to or greater than unit supply voltage.
6. 24-v Alarm Signal shown. For Dry Alarm Contact, cut JW1 jumper and Dry Contact will be available between AL1 and AL2.
7. Transformer secondary ground via Complete C board standoffs and screws to Control Box. (Ground available from top two standoffs as shown.)
8. Suffix 1 designates association with lead compressor. Suffix 2 with lag compressor. EXCEPTION FP1, FP2.
9. DIP switch no. 2 for Complete C 2 should be off.

Fig. 10A — 50VQL200-300 with Complete C Controls (Typical)

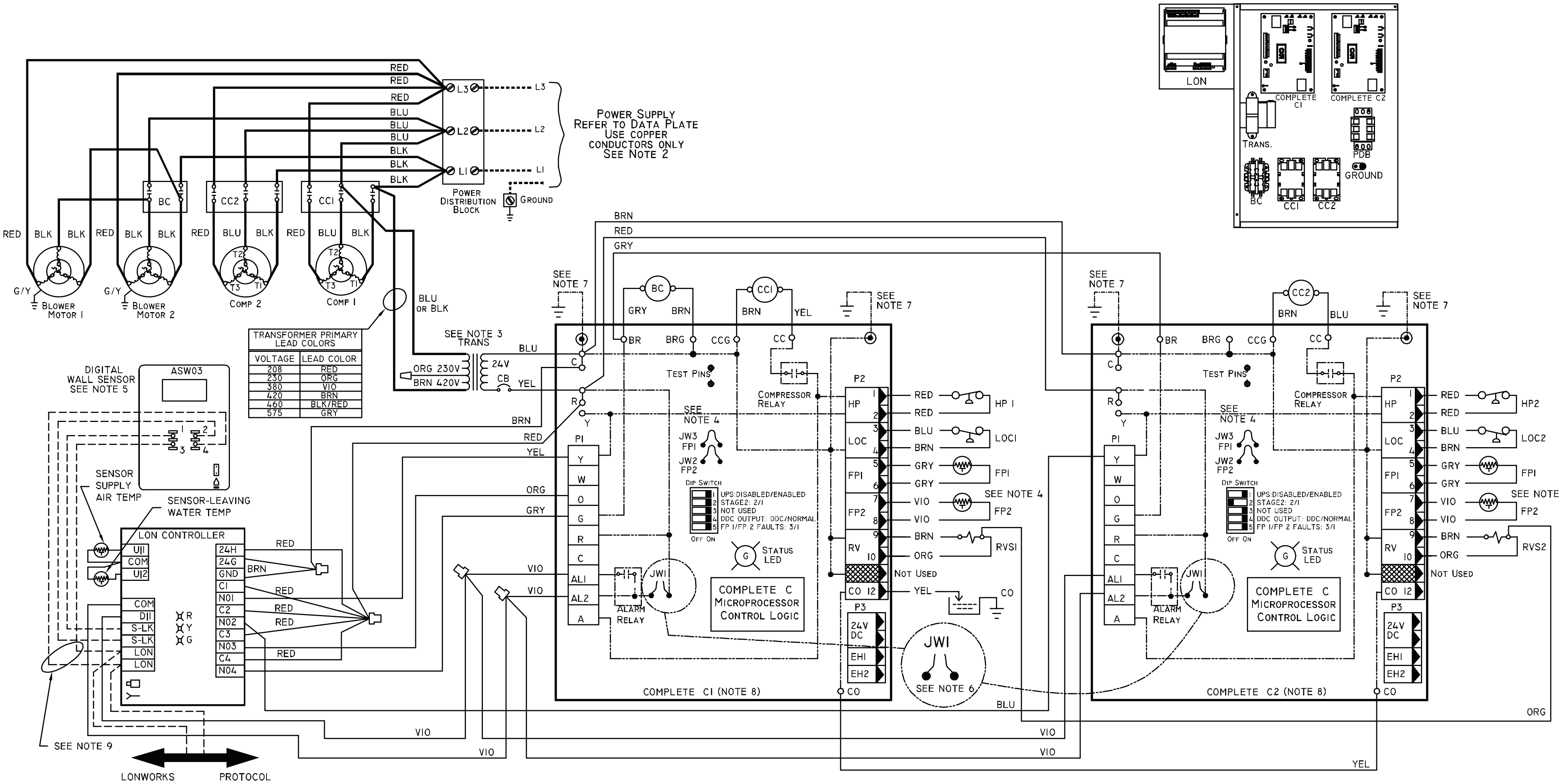


TRANSFORMER PRIMARY LEAD COLORS	
VOLTAGE	LEAD COLOR
208	RED
230	ORG
380	VIO
420	BRN
460	BLK/RED
575	GRY

NOTES:

1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with NEC and local codes.
3. 208/230 v transformers will be connected for 208 v operations. For 230 v operation, disconnect RED lead at L1, and attach ORG lead to L1. Close open end of RED lead.
4. FP1 thermistor provides freeze protection for WATER. When using ANTIFREEZE solutions, cut JW3 jumper.
5. Typical heat pump thermostat wiring shown. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be “Class 1” and voltage rating equal to or greater than unit supply voltage.
6. 24-v Alarm Signal shown. For Dry Alarm Contact, cut AL2 DRY (JW4) Jumper and Dry Contact will be available between AL1 and AL2.
7. Transformer secondary ground via Deluxe D board standoffs and screws to Control Box. (Ground available from top two standoffs as shown.)
8. Suffix 1 designates association with lead compressor. Suffix 2 with lag compressor, EXCEPTION FP1, FP2.

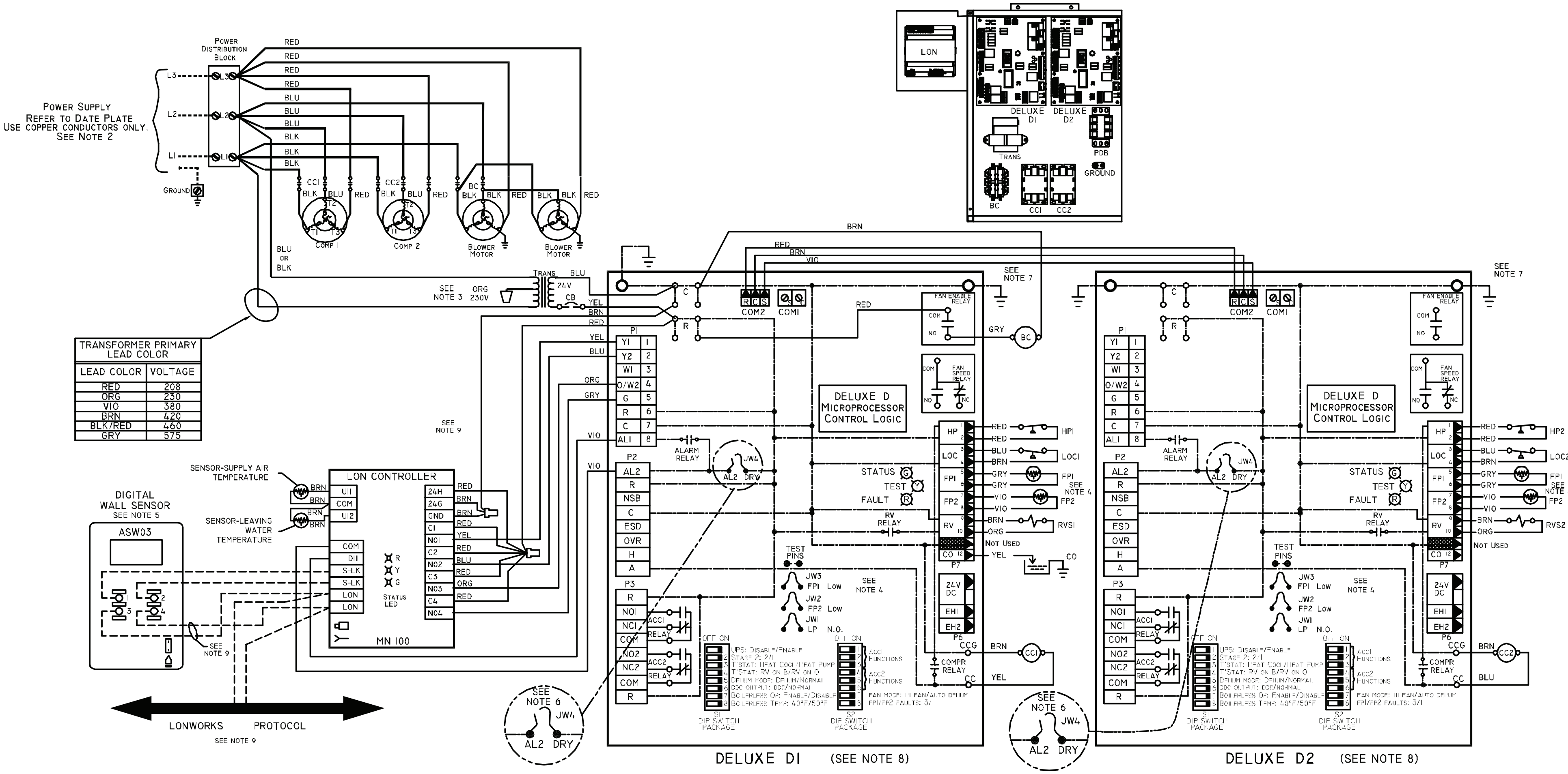
Fig. 10B — 50VQL200-300 with Deluxe D Controls (Typical)



NOTES:

1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with NEC and local codes.
3. Transformer is wired 280V (RED) lead for 208/60/3 units. Connect 208/230V transformers for 208V operations. For 230/60/3 switch RED and ORG leads at L1. Insulate open end of RED lead. Connect 380/420V transformers for 380V operations. For 420V operations, disconnect VIO lead at L1 and attach BRN lead to L1. Insulate open end of VIO lead.
4. FP1 thermister provides freeze protection for water. When using antifreeze solutions, cut JW3 jumper.
5. Typical thermostat wiring shown. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be Class 1 and voltage rating equal to or greater than unit supply voltage.
6. Factory cut JW1 jumper. Dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via Complete C board standoffs and screws to control box. (Ground available from top two standoffs as shown.)
8. Suffix 1 designates association with lead compressor. Suffix 2 with lag compressor. EXCEPTION: FP1 and FP2 ARE PER LEGEND.
9. Optional LON wires. Only connect if LON connection is desired at the wall sensor.

Fig. 11A — 50VQL200-300 with Complete C and LON Controls (Typical)



TRANSFORMER PRIMARY LEAD COLOR	
LEAD COLOR	VOLTAGE
RED	208
ORG	230
VIO	380
BRN	420
BLK/RED	460
GRY	575

NOTES:
1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with NEC and local codes.
3. Transformer is wired 280V (RED) lead for 208/60/3 units. Connect 208/230V transformers for 208V operations. For 230/60/3 switch RED and ORG leads at L1. Insulate open end of RED lead. Connect 380/420V transformers for 380V operations. For 420V operations, disconnect VIO lead at L1 and attach BRN lead to L1. Insulate open end of VIO lead.
4. FP1 thermister provides freeze protection for water. When using antifreeze solutions, cut JW3 jumper.
5. Typical thermostat wiring shown. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be Class 1 and voltage rating equal to or greater than unit supply voltage.
6. Factory cut JW4 jumper. Dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via Deluxe D board standoffs and screws to control box. (Ground available from top two standoffs as shown.)
8. Suffix 1 designates association with lead compressor. Suffix 2 with lag compressor. EXCEPTION: FP1 and FP2 are per legend.
9. Optional LON wires. Only connect if LON connection is desired at the wall sensor.

Fig. 11B — 50VQL200-300 with Deluxe D and LON Controls (Typical)

Table 4 — Electrical Data — 50HQL072-120 Units

UNIT 50HQL	VOLTAGE (3 Ph — 60 Hz)	VOLTAGE RANGE		BLOWER MOTOR FACTORY INSTALLED OPTION	COMPRESSOR			FAN MOTOR		TOTAL FLA	MCA	MOCP*
		Min	Max		Qty	RLA	LRA	HP	FLA			
072	208/230	187	253	Standard	2	10.4	65.5	1.5	5.0	25.8	28.4	35
				Large	2	10.4	65.5	2.0	6.2	27.0	29.6	40
	460	414	506	Standard	2	4.9	33.0	1.5	2.4	12.2	13.4	15
				Large	2	4.9	33.0	2.0	3.1	12.9	14.1	15
096	208/230	187	253	Standard	2	14.3	91.0	2.0	6.5	35.1	38.7	50
				Large	2	14.3	91.0	3.0	8.8	37.4	41.0	50
	460	414	506	Standard	2	7.2	46.0	2.0	3.1	17.5	19.3	25
				Large	2	7.2	46.0	3.0	4.2	18.6	20.4	25
	575	518	633	Standard	2	5.7	37.0	2.0	2.8	14.2	15.6	20
				Large	2	5.7	37.0	3.0	3.4	14.8	16.2	20
120	208/230	187	253	Standard	2	19.3	123.0	2.0	6.5	45.1	49.9	60
				Large	2	19.3	123.0	3.0	8.8	47.4	52.2	70
	460	414	506	Standard	2	7.5	49.5	2.0	3.1	18.1	20.0	25
				Large	2	7.5	49.5	3.0	4.2	19.2	21.1	25
	575	518	633	Standard	2	6.4	40.0	2.0	2.8	15.6	17.2	20
				Large	2	6.4	40.0	3.0	3.4	16.2	17.8	20

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning, and Refrigeration
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Minimum Over Current Protection
RLA — Rated Load Amps

*Time-delay fuse or HACR circuit breaker.

Table 5 — Electrical Data — 50VQL080-300 Units

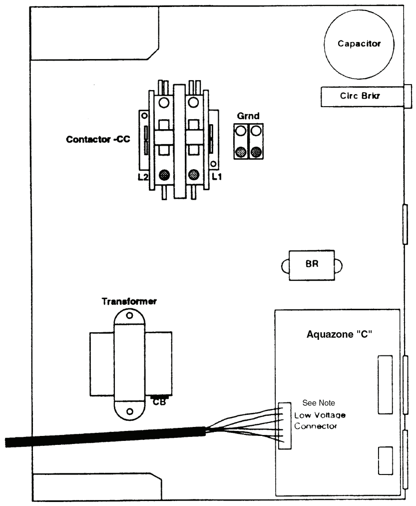
UNIT 50VQL	VOLTAGE (3 Ph - 60 Hz)	VOLTAGE RANGE		BLOWER MOTOR FACTORY-INSTALLED OPTION	COMPRESSOR			FAN MOTOR			UNIT WITH HWR				TOTAL FLA	MCA	MOCP*
		Min	Max		Qty	RLA	LRA	Qty	HP	FLA	REHEAT PUMP FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/ HACR			
080	208-230	197	253	Standard	1	20.7	156	1	1.5	5.0	1.1	26.8	32.0	50	25.7	30.9	50
				Large	1	20.7	156	1	2.0	6.2	1.1	28.0	33.2	50	26.9	32.1	50
	460	414	506	Standard	1	10.0	75	1	1.5	2.4	0.6	12.9	15.4	25	12.4	14.9	20
				Large	1	10.0	75	1	2.0	3.1	0.6	13.7	16.2	25	13.1	15.6	25
	575	518	633	Standard	1	8.2	54	1	1.5	1.9	0.4	10.5	12.6	20	10.1	12.1	20
				Large	1	8.2	54	1	2.0	2.3	0.4	10.9	13.0	20	10.5	12.5	20
100	208-230	197	253	Standard	1	32.1	195	1	1.5	5.8	2.0	39.1	47.1	70	37.9	45.9	70
				Large	1	32.1	195	1	2.0	6.2	2.0	40.3	48.3	80	38.3	46.3	70
	460	414	506	Standard	1	16.4	95	1	1.5	2.4	1.0	19.8	23.9	40	18.8	22.9	35
				Large	1	16.4	95	1	2.0	3.1	1.0	20.5	24.6	40	19.5	23.6	40
	575	518	633	Standard	1	12.0	80	1	1.5	1.9	0.8	14.7	17.7	25	13.9	16.9	25
				Large	1	12.0	80	1	2.0	2.3	0.8	15.1	18.1	30	14.3	17.3	25
120	208-230	197	253	Standard	1	33.6	225	1	2.0	6.2	2.0	41.8	50.2	80	39.8	48.2	80
				Large	1	33.6	225	1	3.0	8.4	2.0	44.4	52.8	80	42.0	50.4	80
	460	414	506	Standard	1	17.3	114	1	2.0	3.1	1.0	21.4	25.7	40	20.4	24.5	40
				Large	1	17.3	114	1	3.0	4.2	1.0	22.5	26.8	40	21.5	25.8	40
	575	518	633	Standard	1	13.5	80	1	2.0	2.3	0.8	16.6	20.0	30	15.8	19.2	30
				Large	1	13.5	80	1	3.0	3.4	0.8	17.7	21.1	30	16.9	20.3	30
160	208-230	197	253	Standard	2	20.7	156	1	3.0	8.4	2.0	52.2	57.3	70	49.8	55.0	70
	460	414	506	Standard	2	10.0	74	1	3.0	4.2	1.0	25.2	27.7	35	24.2	26.7	35
	575	518	633	Standard	2	8.2	54	1	3.0	3.4	0.8	20.6	22.6	30	19.8	21.9	30
200	208-230	197	253	Standard	2	32.1	195	2	1.5	5.0	2.0	76.2	84.2	110	74.2	75.8	110
				Large	2	32.1	195	2	2.0	6.2	2.0	78.6	86.6	110	76.6	84.6	110
	460	414	506	Standard	2	16.4	95	2	1.5	2.4	1.0	38.6	42.7	50	37.6	41.7	50
				Large	2	16.4	95	2	2.0	3.1	1.0	40.0	44.1	60	39.0	43.1	50
	575	518	633	Standard	2	12.0	80	2	1.5	1.9	0.8	28.6	31.6	40	27.8	30.8	40
				Large	2	12.0	80	2	2.0	2.3	0.8	29.4	32.4	40	28.6	31.6	40
240	208-230	197	253	Standard	2	33.6	225	2	2.0	6.2	4.5	84.1	92.5	125	79.6	88.0	110
				Large	2	33.6	225	2	3.0	8.4	4.5	89.3	97.7	125	84.0	92.4	125
	460	414	506	Standard	2	17.3	114	2	2.0	3.1	2.3	43.0	47.4	60	40.8	45.1	60
				Large	2	17.3	114	2	3.0	4.2	2.3	45.3	49.6	60	43.0	47.3	60
	575	518	633	Standard	2	13.5	80	2	2.0	2.3	1.8	33.4	36.8	50	31.6	35.0	45
				Large	2	13.5	80	2	3.0	3.4	1.8	35.6	39.0	50	33.8	37.2	50
300	208-230	197	253	Standard	2	47.1	245	2	3.0	8.4	4.5	116.3	128.1	175	111.0	122.8	150
	460	414	506	Standard	2	19.6	125	2	3.0	4.2	2.3	49.8	54.8	70	47.6	52.5	70
	575	518	633	Standard	2	15.8	100	2	3.0	3.4	1.8	40.2	44.2	50	38.4	42.4	50

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning, and Refrigeration
HWR — Hot Water Reheat
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Minimum Over Current Protection
RLA — Rated Load Amps

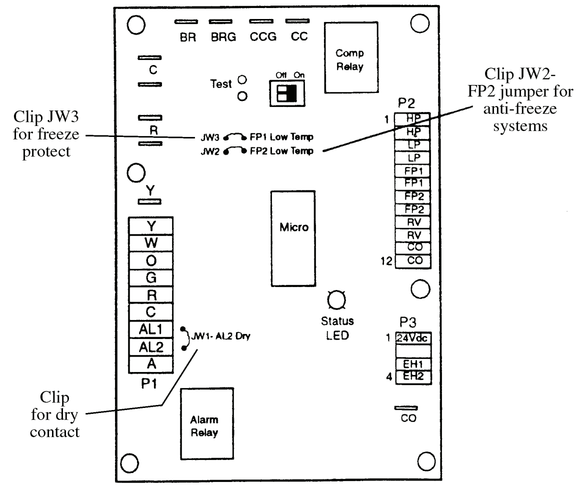
*Time-delay fuse or HACR circuit breaker.

NOTE: Contact factory for electrical data with optional oversize blower motor.



NOTE: Low voltage connector may be removed for easy installation.

Fig. 12 — Low Voltage Field Wiring



AQUAZONE CONTROL (Complete C Control Shown)

Fig. 13 — Typical Aquazone™ Control Board Jumper Locations

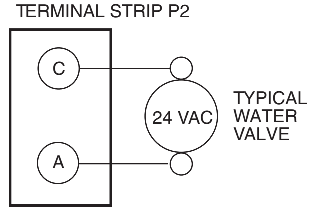


Fig. 14 — Typical Aquazone Accessory Wiring (Control D Shown)

PRE-START-UP

System Checkout — When the installation is complete, follow the system checkout procedure outlined below before starting up the system. Be sure:

1. Voltage is within the utilization range specifications of the unit compressor and fan motor and voltage is balanced for 3-phase units.
2. Fuses, breakers and wire are correct size.
3. Low voltage wiring is complete.
4. Piping and system flushing is complete.
5. Air is purged from closed loop system.
6. System is balanced as required. Monitor if necessary.
7. Isolation valves are open.
8. Water control valves or loop pumps are wired.
9. Condensate line is open and correctly pitched.
10. Transformer switched to lower voltage tap if necessary.
11. Blower rotates freely — shipping support is removed.
12. Blower speed is on correct setting.
13. Air filter is clean and in position.
14. Service/access panels are in place.
15. Return-air temperature is 40 to 80 F for heating and 50 to 110 F for cooling.
16. Air coil is clean.
17. Control field selected settings are correct.

AIR COIL — To obtain maximum performance, the air coil should be cleaned before starting the unit. A ten percent solution of dishwasher detergent and water is recommended for both sides of the coil. Rinse thoroughly with water.

Airflow and External Static Pressure — The 50HQL,VQL units are available with standard, low, and high-static factory-installed options. These options will substitute a different blower drive sheave for each static range. In addition, certain static ranges may require the optional large fan motor.

SHEAVE ADJUSTMENT — The 50HQL,VQL units are supplied with a variable sheave drive on the fan motor to adjust for differing airflows at various ESP (external static pressure) conditions. See Tables 6-16 for unit airflows. When fully closed, the sheave will produce the highest static capability (higher rpm). To adjust sheave position, follow the procedure outlined below:

1. Loosen belt tension and remove belt.
2. Loosen set screw on fan motor.
3. Open sheave to desired position.
4. Retighten set screw and replace belt.

NOTE: Set belt tension as outlined below.

BELT TENSION ADJUSTMENT — An overly loose belt will, upon starting motor, produce a slippage "squeal" and cause premature belt failure and or intermittent airflow. An overly tight belt can cause premature motor or blower bearing failure. To adjust the belt tension, follow the procedure outlined below:

1. Remove belt from motor sheave.
2. Lift motor assembly.
3. Loosen the $^5/_{16}$-in. hex nuts on the grommet motor adjustment bolts (2 per bolt). To increase the belt tension loosen the top hex nut. To decrease the belt tension loosen the bottom hex nut.
4. Turn the bolts by hand to the desired position then tighten the $^5/_{16}$-in. hex nuts (2 per bolt).
5. Lower the motor assembly.
6. Install the belt.
7. The belt tension can be adjusted by using one of the following methods:
   a. Tighten until belt deflects approximately $^1/_2$-in. with very firm finger pressure.
   b. Grasp belt midway between two pulleys and twist for a 90-degree rotation.
      NOTE: Adjusting less than 90 degrees will over-tighten the belt and adjusting more than 90 degrees will loosen belt.
   c. Set proper belt tension to 70 to 80 lb.

NOTE: The motor position should not need adjustment. Motor sheave position is at mid position of each sheave. For example, the motor sheave is 2.5 turns open on a 5-turn sheave. The belt tension adjustment can also be accomplished by turning the $^5/_{16}$-in. hex nuts to the desired position.

NOTE: Available airflows for all units are shown in Tables 6-16.

Table 6 — 50HQL072 Blower Performance Data

RATED CFM		EXTERNAL STATIC PRESSURE (in. wg)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
1800	BHP	—	0.23	0.26	0.31	0.35	0.39	0.44	0.48	0.53	0.58	0.63	0.68	0.73	0.79	0.84	0.90
	RPM	—	482	536	587	636	683	729	773	816	858	899	938	977	1015	1052	1088
	Turns Open	—	5.0	4.0	3.0	2.0	1.0	5.0	4.0	3.0	2.5	1.5	1.0	0.0	3.5	3.0	2.5
2000	BHP	0.27	0.31	0.35	0.40	0.44	0.49	0.54	0.59	0.64	0.69	0.75	0.80	0.86	0.91	0.97	1.03
	RPM	484	534	582	629	674	717	760	801	841	881	919	956	993	1029	1064	1098
	Turns Open	5.0	4.0	3.0	2.0	1.5	5.0	4.0	3.5	2.5	2.0	1.0	0.5	4.0	3.5	3.0	2.5
2200	BHP	0.36	0.41	0.46	0.51	0.56	0.61	0.66	0.72	0.77	0.83	0.88	0.94	1.00	1.06	1.12	1.18
	RPM	544	589	633	676	717	758	797	836	873	910	946	982	1016	1050	1084	1116
	Turns Open	4.0	3.0	2.0	1.5	5.0	4.0	3.5	3.0	2.0	1.5	0.5	0.0	3.5	3.0	2.5	2.0
2400	BHP	0.49	0.54	0.59	0.64	0.70	0.75	0.81	0.87	0.93	0.99	1.05	1.11	1.17	1.24	1.30	1.37
	RPM	605	647	687	726	765	802	839	875	910	945	979	1012	1045	1077	1109	1140
	Turns Open	2.5	2.0	1.0	5.0	4.0	3.5	2.5	2.0	1.5	0.5	0.0	3.5	3.0	3.0	2.5	2.0
2600	BHP	0.64	0.69	0.75	0.81	0.86	0.92	0.99	1.05	1.11	1.17	1.24	1.30	**1.37**	**1.44**	**1.51**	**1.57**
	RPM	667	705	742	779	814	849	884	917	950	983	1015	1046	**1078**	**1108**	**1138**	**1168**
	Turns Open	1.5	1.0	4.5	4.0	3.0	2.5	2.0	1.0	0.5	0.0	3.5	3.0	**2.5**	**2.5**	**2.0**	**1.5**
2800	BHP	0.81	0.87	0.93	1.00	1.06	1.12	1.19	**1.25**	**1.32**	**1.39**	**1.46**	**1.52**	**1.60**	**1.67**	**1.74**	**1.81**
	RPM	729	764	799	833	866	899	931	**962**	**993**	**1024**	**1054**	**1084**	**1114**	**1143**	**1171**	**1199**
	Turns Open	5.0	4.0	3.5	3.0	2.0	1.5	1.0	**0.5**	**0.0**	**3.5**	**3.0**	**2.5**	**2.0**	**2.0**	**1.5**	**1.0**
3000	BHP	1.02	1.09	1.15	1.22	1.29	**1.35**	**1.42**	**1.49**	**1.56**	**1.64**	**1.71**	**1.78**	**1.85**	**1.93**	—	—
	RPM	793	825	858	889	920	**951**	**981**	**1011**	**1040**	**1069**	**1098**	**1126**	**1154**	**1182**	—	—
	Turns Open	3.5	3.0	2.5	1.5	1.0	**0.5**	**0.0**	**3.5**	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**	—	—

LEGEND

— — Operation Not Recommended
ARI — Air Conditioning and Refrigeration Institute
BHP — Brake Horsepower
ESP — External Static Pressure
RPM — Revolutions Per Minute
ISO — International Organization for Standardization
A — Units with Standard Static/Standard Motor Option
B — Units with Low-Static/Standard Motor Option
C — Units with High-Static/Standard Motor Option
E — Units with High-Static/Large Motor Option

NOTES:
1. **Boldface** requires 2 hp motor.
2. Factory shipped with standard static sheave and drive at 2.5 turns open (2400 cfm at 0.5 in. wg ESP Wet Coil). Other speeds require field selection.
3. ISO/ARI rating point with standard static sheave and drive at 3.5 turns open (2400 cfm at 0.5 in. wg ESP Wet Coil). Other speeds require field selection.
4. For applications requiring higher static pressures, contact your local representative.
5. Based on 12x11 blower.
6. Performance data does not include drive losses and is based on sea level conditions.
7. All airflow is rated at lowest voltage if unit is dual voltage rated, i.e., 208 V for 208-230 V units.
8. For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]). Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg and 500 fpm by 0.16 in. wg.
9. Large motor size is 2 hp for 50HQL072.

Table 7 — 50HQL096 Blower Performance Data

RATED CFM		EXTERNAL STATIC PRESSURE (in. wg)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
2600	BHP	—	—	0.84	0.91	0.97	1.04	1.10	1.17	1.24	1.31	1.37	1.44	1.51	1.58	1.65	1.72
	RPM	—	—	1048	1095	1140	1184	1226	1267	1308	1346	1384	1421	1457	1493	1527	1560
	Turns Open	—	—	4.0	3.0	2.0	1.0	0.0	4.0	3.5	2.5	2.0	1.5	1.0	4.5	4.0	3.5
2800	BHP	0.87	0.94	1.01	1.08	1.15	1.22	1.29	1.36	1.43	1.51	1.58	1.65	1.73	1.80	1.87	1.95
	RPM	1012	1058	1104	1148	1191	1232	1273	1313	1351	1389	1426	1461	1497	1531	1564	1597
	Turns Open	4.5	3.5	2.5	2.0	1.0	4.5	4.0	3.5	2.5	2.0	1.5	1.0	4.5	4.0	3.5	3.0
3000	BHP	1.05	1.12	1.20	1.27	1.35	1.42	1.50	1.57	1.65	1.73	1.80	1.88	1.96	**2.04**	**2.12**	**2.20**
	RPM	1070	1114	1157	1199	1239	1280	1319	1356	1394	1430	1465	1501	1534	**1568**	**1601**	**1632**
	Turns Open	3.5	2.5	1.5	0.5	4.5	4.0	3.0	2.5	2.0	1.5	0.5	0.0	4.0	**3.5**	**3.0**	**2.5**
3200	BHP	1.25	1.32	1.40	1.48	1.56	1.64	1.72	1.80	1.88	**2.00**	**2.04**	**2.13**	**2.21**	**2.29**	**2.38**	**2.46**
	RPM	1126	1167	1208	1248	1287	1325	1362	1400	1435	**1470**	**1505**	**1538**	**1571**	**1604**	**1636**	**1667**
	Turns Open	2.5	1.5	0.5	4.5	3.5	3.0	2.5	2.0	1.0	**0.5**	**0.0**	**4.0**	**3.5**	**3.0**	**2.5**	**2.0**
3400	BHP	1.46	1.54	1.62	1.71	1.79	1.88	1.96	**2.05**	**2.13**	**2.22**	**2.31**	**2.39**	**2.48**	**2.57**	**2.65**	**2.74**
	RPM	1179	1219	1257	1296	1333	1369	1406	**1441**	**1475**	**1510**	**1543**	**1576**	**1608**	**1639**	**1671**	**1702**
	Turns Open	1.0	0.5	4.5	3.5	3.0	2.5	1.5	**1.0**	**0.5**	**0.0**	**4.0**	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**
3600	BHP	1.69	1.78	1.87	1.95	**2.04**	**2.13**	**2.22**	**2.31**	**2.40**	**2.49**	**2.58**	**2.67**	**2.76**	**2.85**	**2.94**	—
	RPM	1230	1268	1305	1341	**1377**	**1413**	**1447**	**1481**	**1515**	**1548**	**1580**	**1612**	**1643**	**1674**	**1705**	—
	Turns Open	4.5	4.0	3.5	3.0	**2.0**	**1.5**	**1.0**	**0.5**	**0.0**	**4.0**	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	—
3800	BHP	1.94	**2.03**	**2.13**	**2.22**	**2.31**	**2.41**	**2.50**	**2.59**	**2.69**	**2.78**	**2.88**	**2.97**	—	—	—	—
	RPM	1280	**1316**	**1351**	**1387**	**1421**	**1455**	**1488**	**1521**	**1553**	**1586**	**1617**	**1648**	—	—	—	—
	Turns Open	4.0	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**	**0.5**	**4.0**	**3.5**	**3.0**	**3.0**	**2.5**	—	—	—	—

LEGEND

— — Operation Not Recommended
ARI — Air Conditioning and Refrigeration Institute
BHP — Brake Horsepower
ESP — External Static Pressure
ISO — International Organization for Standardization
RPM — Revolutions Per Minute
A — Units with Standard Static Sheave/Standard Motor Option
B — Units with Low-Static Sheave/Standard Motor Option
C — Units with High-Static Sheave/Standard Motor Option
D — Units with Standard Static Sheave/Large 3 Hp Motor Option
E — Units with High-Static Sheave/Large 3 Hp Motor Option

NOTES:
1. **Boldface** requires 3 hp motor.
2. Units factory shipped with standard static sheave and drive at 2.5 turns open (3200 cfm at 0.6 in. wg ESP). Other speeds require field selection. ISO/ARI rating point with standard static sheave and drive at 3.5 turns open (3200 cfm at 0.4 in. wg ESP). Other speeds require field selection.
3. For applications requiring higher static pressures, contact your local representative.
4. Based on 2-10x10 blowers.
5. Performance data does not include drive losses and is based on sea level conditions.
6. All airflow is rated at lowest voltage if unit is dual voltage rated, i.e., 208V for 208-230V units.
7. For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]). Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg and 500 fpm by 0.16 in. wg.
8. Large motor size is 3 hp for 50HQL096.

Table 8 — 50HQL120 Blower Performance Data

RATED CFM		EXTERNAL STATIC PRESSURE (in. wg)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
3400	BHP	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.54	1.59	1.63	1.68	1.73	1.77	1.82
	RPM	1014	1043	1072	1102	1129	1156	1183	1209	1234	1260	1285	1309	1333	1356	1380	1403
	Turns Open	3.0	2.5	2.0	1.0	0.5	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0	4.5	4.0	4.0
3600	BHP	1.26	1.31	1.37	1.42	1.48	1.53	1.58	1.63	1.68	1.74	1.79	1.84	1.89	1.94	1.99	**2.04**
	RPM	1052	1081	1109	1136	1163	1190	1216	1241	1266	1291	1315	1338	1362	1385	1408	**1430**
	Turns Open	2.5	1.5	1.0	0.5	4.0	3.5	3.0	2.5	2.5	2.0	1.5	1.0	4.5	4.0	3.5	**3.5**
3800	BHP	1.44	1.50	1.56	1.61	1.67	1.73	1.78	1.84	1.89	1.95	2.00	**2.06**	**2.11**	**2.16**	**2.21**	**2.26**
	RPM	1090	1118	1145	1172	1199	1223	1248	1273	1298	1321	1345	**1368**	**1391**	**1413**	**1435**	**1457**
	Turns Open	1.5	1.0	0.0	4.0	3.5	3.0	2.5	2.0	1.5	1.0	1.0	**0.5**	**0.0**	**3.5**	**3.5**	**3.0**
4000	BHP	1.63	1.70	1.76	1.82	1.88	1.94	2.00	**2.06**	**2.11**	**2.17**	**2.22**	**2.28**	**2.34**	**2.39**	**2.45**	**2.50**
	RPM	1127	1154	1181	1207	1232	1257	1281	**1306**	**1329**	**1352**	**1375**	**1398**	**1420**	**1441**	**1463**	**1485**
	Turns Open	0.5	4.5	4.0	3.5	3.0	2.5	2.0	**1.5**	**1.0**	**0.5**	**0.0**	**0.0**	**3.5**	**3.0**	**3.0**	**2.5**
4200	BHP	1.84	1.91	1.98	**2.04**	**2.10**	**2.16**	**2.22**	**2.28**	**2.34**	**2.40**	**2.47**	**2.53**	**2.59**	**2.65**	**2.71**	**2.77**
	RPM	1164	1191	1217	**1241**	**1266**	**1291**	**1314**	**1337**	**1360**	**1383**	**1406**	**1427**	**1449**	**1470**	**1492**	**1513**
	Turns Open	4.0	3.5	3.0	**2.5**	**2.5**	**2.0**	**1.5**	**1.0**	**0.5**	**0.0**	**3.5**	**3.5**	**3.0**	**2.5**	**2.5**	**2.0**
4400	BHP	**2.07**	**2.13**	**2.20**	**2.27**	**2.33**	**2.40**	**2.46**	**2.53**	**2.60**	**2.66**	**2.73**	**2.79**	**2.86**	**2.93**	**2.99**	—
	RPM	**1202**	**1227**	**1251**	**1276**	**1300**	**1323**	**1346**	**1369**	**1392**	**1414**	**1435**	**1457**	**1478**	**1500**	**1520**	—
	Turns Open	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**	**1.0**	**0.5**	**0.0**	**3.5**	**3.5**	**3.0**	**2.5**	**2.5**	**2.0**	—
4600	BHP	**2.30**	**2.37**	**2.44**	**2.51**	**2.59**	**2.66**	**2.73**	**2.80**	**2.87**	**2.95**	—	—	—	—	—	—
	RPM	**1237**	**1262**	**1287**	**1310**	**1333**	**1356**	**1379**	**1402**	**1423**	**1444**	—	—	—	—	—	—
	Turns Open	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**	**0.5**	**0.0**	**4.0**	**3.5**	**3.0**	—	—	—	—	—	—

LEGEND

— — Operation Not Recommended
ARI — Air Conditioning and Refrigeration Institute
BHP — Brake Horsepower
ESP — External Static Pressure
ISO — International Organization for Standardization
RPM — Revolutions Per Minute
A — Units with Standard Static Sheave/Standard Motor Option
B — Units with Low-Static Sheave/Standard Motor Option
C — Units with High-Static Sheave/Standard Motor Option
D — Units with Standard Static Sheave/Large 3 Hp Motor Option
E — Units with High-Static Sheave/Large 3 Hp Motor Option

NOTES:
1. **Boldface** requires 3 hp motor.
2. Units factory shipped at ISO/ARI setting with standard static sheave and drive at 2.5 turns open (4000 cfm at 0.5 in. wg ESP). Other speeds require field selection.
3. For applications requiring higher static pressures, contact your local representative.
4. Based on 2-11x10 blowers.
5. Performance data does not include drive losses and is based on sea level conditions.
6. All airflow is rated at lowest voltage if unit is dual voltage rated, i.e., 208V for 208-230V units.
7. For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]). Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg and 500 fpm by 0.16 in. wg.

Table 9 — 50VQL080 Blower Performance Data

RATED CFM		EXTERNAL STATIC PRESSURE (in. wg)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
2000	BHP	0.36	0.39	0.43	0.47	0.51	0.55	0.59	0.63	0.67	0.71	0.76	0.80	0.84	0.89	0.93	0.98
	RPM	600	641	681	720	757	794	829	864	898	931	964	996	1027	1058	1088	1117
	Turns Open	3	2	1	0.5	4.5	3.5	3	2	1.5	1	0.5	3	2.5	2	1.5	1
2200	BHP	0.45	0.49	0.53	0.57	0.61	0.65	0.70	0.74	0.79	0.83	0.88	0.92	0.97	1.02	1.06	1.11
	RPM	633	671	708	745	780	814	848	881	913	945	976	1006	1036	1066	1095	1123
	Turns Open	2	1.5	0.5	4.5	4	3	2.5	2	1.5	0.5	0	3	2.5	2	1.5	1
2400	BHP	0.55	0.60	0.64	0.69	0.73	0.78	0.82	0.87	0.92	0.97	1.02	1.07	1.11	1.16	1.22	1.27
	RPM	670	705	740	774	807	840	872	903	934	964	993	1022	1051	1079	1107	1134
	Turns Open	1.5	1	4.5	4	3.5	2.5	2	1.5	1	0.5	3	2.5	2	2	1.5	1
2600	BHP	0.68	0.73	0.77	0.82	0.87	0.92	0.97	1.02	1.07	1.12	1.17	1.22	1.28	1.33	1.38	1.44
	RPM	708	741	773	805	837	867	898	927	957	985	1013	1041	1069	1096	1122	1149
	Turns Open	0.5	4.5	4	3.5	2.5	2	1.5	1	0.5	0	3	2.5	2	1.5	1	0.5
2800	BHP	0.82	0.87	0.92	0.97	1.02	1.08	1.13	1.18	1.24	1.29	1.34	1.40	**1.45**	**1.51**	**1.57**	**1.62**
	RPM	744	775	806	836	866	895	924	952	980	1007	1034	1061	**1087**	**1113**	**1138**	**1164**
	Turns Open	4.5	4	3.5	3	2	1.5	1	0.5	0	3	2.5	2	**1.5**	**1.5**	**1**	**0.5**
3000	BHP	0.97	1.03	1.08	1.14	1.19	1.25	1.30	1.36	**1.41**	**1.47**	**1.53**	**1.59**	**1.65**	**1.70**	**1.76**	**1.82**
	RPM	777	807	836	865	893	921	948	975	**1002**	**1028**	**1054**	**1079**	**1104**	**1129**	**1154**	**1178**
	Turns Open	4	3.5	3	2	1.5	1	0.5	0	**3**	**2.5**	**2**	**2**	**1.5**	**1**	**0.5**	**0**
3200	BHP	1.14	1.19	1.25	1.31	1.36	1.42	**1.48**	**1.54**	**1.60**	**1.66**	**1.72**	**1.78**				
	RPM	807	835	862	890	917	943	**969**	**995**	**1021**	**1046**	**1071**	**1095**				
	Turns Open	3.5	3	2.5	1.5	1	0.5	**3**	**3**	**2.5**	**2**	**2**	**1.5**				

LEGEND

A — Standard Static Sheave/Standard Motor
B — Low-Static Sheave/Standard Motor
C — High-Static Sheave/Standard Motor Option
E — High-Static Sheave/Large Motor
ARI — Air Conditioning and Refrigeration Institute
BHP — Brake Horsepower
ESP — External Static Pressure
ISO — International Organization for Standardization
RPM — Revolutions Per Minute

NOTES:
1. **Bold** numbers require 2 horsepower motor.
2. Due to alternate sheaves, 'Turns Open' may vary within ±0.5 turn from the position shown above.
3. Units factory shipped with standard static sheave and drive at 2.5 turns open (2600 cfm at 0.4 in. wg ESP Wet Coil). Other speeds require field selection.
4. ISO/ARI rating point with standard static sheave and drive at 2 turns open (2600 cfm at 0.48 in. wg ESP Wet Coil). Other speeds require field selection.
5. For applications requiring higher static pressures, contact your local representative.
6. Performance data does not include drive losses and is based on sea level conditions.
7. Do not operate in gray region.
8. All airflow is rated at lowest voltage if unit is dual voltage rated, i.e., 208 v for 208-230-v units.
9. For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm]/Face Area [sq ft]). Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg and 500 fpm by 0.16 in. wg.

Table 10 — 50VQL100 Blower Performance Data

RATED CFM		EXTERNAL STATIC PRESSURE (in. wg)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
2700	**BHP**				0.50	0.56	0.63	0.70	0.77	0.84	0.90	0.97	1.03	1.10	1.17	1.23	1.30
	RPM				561	599	635	670	704	736	767	797	826	854	881	907	933
	Turns Open				4.5	3.5	2.5	1.5	4.5	4	3.5	3	2	1.5	1	0.5	0
2900	**BHP**				0.57	0.63	0.70	0.78	0.86	0.92	0.99	1.06	1.13	1.20	1.26	1.33	1.40
	RPM				576	613	648	682	714	746	776	805	833	861	887	913	938
	Turns Open				4	3	2	1	4.5	4	3	2.5	2	1.5	1	0.5	0
3100	**BHP**			0.58	0.64	0.71	0.78	0.86	0.94	1.02	1.10	1.19	1.27	1.35	1.43	**1.52**	**1.60**
	RPM			553	590	626	660	693	724	755	784	813	841	868	894	**919**	**944**
	Turns Open			4.5	3.5	2.5	2	1	4.5	3.5	3	2.5	2	1.5	1	**2.5**	**2**
3300	**BHP**			0.66	0.73	0.80	0.87	0.94	1.02	1.11	1.19	1.28	1.36	**1.45**	**1.53**	**1.62**	**1.70**
	RPM			569	604	638	671	703	734	764	793	821	848	**874**	**900**	**925**	**950**
	Turns Open			4	3	2.5	1.5	4.5	4	3.5	3	2.5	2	**3.5**	**3**	**2.5**	**2**
3500	**BHP**		0.68	0.75	0.82	0.89	0.96	1.04	1.12	1.21	1.28	1.36	1.44	**1.52**	**1.59**	**1.67**	**1.75**
	RPM		549	584	618	651	683	714	744	773	802	829	856	**882**	**907**	**932**	**956**
	Turns Open		4.5	3.5	3	2	1	4.5	4	3.5	2.5	2	1.5	**3**	**2.5**	**2**	**2**
3700	**BHP**		0.78	0.85	0.92	0.99	1.07	1.15	1.23	1.31	1.40	**1.48**	**1.55**	**1.63**	**1.70**	**1.78**	
	RPM		566	600	633	665	696	726	755	783	811	**838**	**864**	**889**	**914**	**939**	
	Turns Open		4	3.5	2.5	1.5	1	4	3.5	3	2.5	**4**	**3.5**	**3**	**2.5**	**2**	
3900	**BHP**	0.82	0.89	0.96	1.03	1.10	1.18	1.26	1.35	1.43	**1.52**	**1.62**	**1.71**	**1.81**			
	RPM	550	584	616	648	679	709	738	766	794	**821**	**847**	**873**	**898**			
	Turns Open	4.5	3.5	3	2	1.5	4.5	4	3.5	3	**4**	**4**	**3.5**	**3**			
4100	**BHP**	0.93	1.00	1.08	1.15	1.23	1.31	1.39	**1.48**	**1.56**	**1.66**	**1.75**	**1.85**				
	RPM	570	602	633	664	693	722	751	**778**	**805**	**832**	**857**	**883**				
	Turns Open	4	3.5	2.5	1.5	1	4.5	3.5	**5**	**4.5**	**4**	**3.5**	**3**				

LEGEND

A — Standard Static Sheave/Standard Motor
B — Low-Static Sheave/Standard Motor
E — High-Static Sheave/Large Motor
ARI — Air Conditioning and Refrigeration Institute
BHP — Brake Horsepower
ESP — External Static Pressure
ISO — International Organization for Standardization
RPM — Revolutions Per Minute

NOTES:
1. **Bold** numbers require 2 horsepower motor.
2. Due to alternate sheaves, 'Turns Open' may vary within ±0.5 turn from the position shown above.
3. Units factory shipped with standard static sheave and drive at 2.5 turns open (3500 cfm at 0.7 in. wg ESP Wet Coil). Other speeds require field selection.
4. ISO/ARI rating point with standard static sheave and drive at 3.5 turns open (3500 cfm at 0.45 in. wg ESP Wet Coil). Other speeds require field selection.
5. For applications requiring higher static pressures, contact your local representative.
6. Performance data does not include drive losses and is based on sea level conditions.
7. Do not operate in gray region.
8. All airflow is rated at lowest voltage if unit is dual voltage rated, i.e., 208 v for 208-230-v units.
9. For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm]/Face Area [sq ft]). Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg and 500 fpm by 0.16 in. wg.

Table 11 — 50VQL120 Blower Performance Data

RATED CFM		EXTERNAL STATIC PRESSURE (in. wg)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
2800	**BHP**				0.53	0.60	0.67	0.74	0.81	0.87	0.94	1.01	1.08	1.15	1.21	1.28	1.35
	RPM				569	606	642	676	709	741	771	801	830	857	884	910	936
	Turns Open				4	3	2.5	1.5	4.5	4	3.5	2.5	2	1.5	1	0.5	0
3000	**BHP**			0.54	0.60	0.67	0.74	0.82	0.89	0.98	1.06	1.16	1.22	1.29	1.36	1.43	1.50
	RPM			546	583	619	654	687	719	750	780	809	837	864	891	916	941
	Turns Open			4.5	4	3	2	1	4.5	4	3	2.5	2	1.5	1	0.5	0
3200	**BHP**			0.62	0.68	0.75	0.82	0.90	0.98	1.06	1.15	1.24	1.34	1.43	1.51	1.58	1.65
	RPM			561	597	632	666	698	729	759	789	817	844	871	897	922	947
	Turns Open			4.5	3.5	2.5	1.5	1	4	3.5	3	2.5	2	1.5	1	0.5	0
3400	**BHP**			0.70	0.77	0.84	0.91	0.99	1.07	1.16	1.24	1.33	1.42	1.50	1.58	1.67	1.75
	RPM			576	611	645	677	709	739	769	797	825	852	878	904	929	953
	Turns Open			4	3	2	1.5	4.5	4	3.5	3	2.5	1.5	1	0.5	0	2
3600	**BHP**		0.73	0.80	0.87	0.94	1.01	1.09	1.17	1.26	1.35	1.44	1.53	1.63	1.69	1.74	1.80
	RPM		557	592	625	658	689	720	750	778	806	833	860	886	911	935	959
	Turns Open		4.5	3.5	2.5	2	1	4.5	4	3	2.5	2	1.5	1	0.5	0	2
3800	**BHP**		0.83	0.90	0.97	1.05	1.12	1.20	1.29	1.37	1.46	1.55	1.65	1.75	**1.85**	**1.95**	**2.06**
	RPM		575	608	640	672	702	732	760	788	816	842	868	894	**918**	**943**	**966**
	Turns Open		4	3	2.5	1.5	4.5	4	3.5	3	2.5	2	1.5	1	**0.5**	**2**	**1.5**
4000	**BHP**	0.87	0.94	1.01	1.09	1.16	1.24	1.33	1.41	1.50	1.59	1.68	1.78	**1.88**	**1.98**	**2.08**	**2.19**
	RPM	560	593	624	656	686	715	744	772	799	826	852	878	**902**	**927**	**951**	**974**
	Turns Open	4.5	3.5	2.5	2	1	4.5	4	3.5	3	2	1.5	1	**0.5**	**2.5**	**2**	**1.5**
4200	**BHP**	0.99	1.07	1.14	1.22	1.29	1.38	1.46	1.55	1.63	1.73	1.82	**1.92**	**2.02**	**2.12**	**2.23**	**2.34**
	RPM	580	611	642	672	701	729	757	785	811	837	863	**888**	**912**	**936**	**960**	**983**
	Turns Open	4	3	2.5	1.5	4.5	4	3.5	3	2.5	2	1.5	**1**	**2.5**	**2**	**2**	**1.5**
4400	**BHP**	1.13	1.20	1.28	1.36	1.44	1.52	1.61	1.69	1.79	**1.88**	**1.98**	**2.07**	**2.17**	**2.28**	**2.39**	**2.49**
	RPM	601	631	660	689	717	745	772	798	824	**850**	**875**	**899**	**923**	**947**	**970**	**993**
	Turns Open	3.5	2.5	2	1	4.5	4	3.5	3	2.5	**2**	**3.5**	**3**	**2.5**	**2**	**1.5**	**1**
4600	**BHP**	1.27	1.35	1.43	1.51	1.59	1.68	1.77	**1.86**	**1.95**	**2.05**	**2.14**	**2.25**	**2.35**	**2.45**	**2.56**	**2.67**
	RPM	623	652	680	707	734	761	787	**813**	**839**	**864**	**888**	**912**	**936**	**959**	**981**	**1003**
	Turns Open	2.5	2	1.5	4.5	4	3.5	3	**2.5**	**4**	**3.5**	**3**	**2.5**	**2**	**2**	**1.5**	**1**

LEGEND

A — Standard Static Sheave/Standard Motor
B — Low-Static Sheave/Standard Motor
C — High-Static Sheave/Standard Motor
E — High-Static Sheave/Large Motor
ARI — Air Conditioning and Refrigeration Institute
BHP — Brake Horsepower
ESP — External Static Pressure
ISO — International Organization for Standardization
RPM — Revolutions Per Minute

NOTES:
1. **Bold** numbers require 3 horsepower motor.
2. Due to alternate sheaves, 'Turns Open' may vary within ±0.5 turn from the position shown above.
3. Units factory shipped with standard static sheave and drive at 2.5 turns open (4000 cfm at 0.5 in. wg ESP Wet Coil). Other speeds require field selection.
4. ISO/ARI rating point with standard static sheave and drive at 2 turns open (4000 cfm at 0.6 in. wg ESP Wet Coil). Other speeds require field selection.
5. For applications requiring higher static pressures, contact your local representative.
6. Performance data does not include drive losses and is based on sea level conditions.
7. Do not operate in gray region.
8. All airflow is rated at lowest voltage if unit is dual voltage rated, i.e., 208 v for 208-230-v units.
9. For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm]/Face Area [sq ft]). Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg and 500 fpm by 0.16 in. wg.

Table 12 — 50VQL160 Blower Performance Data

RATED CFM		EXTERNAL STATIC PRESSURE (in. wg) 0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
4000	BHP	0.71	0.79	0.86	0.94	1.02	1.10	1.18	1.26	1.34	1.43	1.51	1.60	1.69	1.78	1.87	1.96
	RPM	600	641	681	720	757	794	829	864	898	931	964	996	1027	1058	1088	1117
	Turns Open	3	2	1	0.5	4.5	3.5	3	2	1.5	1	0.5	3	2.5	2	1.5	1
4400	BHP	0.89	0.97	1.06	1.14	1.22	1.31	1.40	1.48	1.57	1.66	1.75	1.85	1.94	2.03	2.13	2.23
	RPM	633	671	708	745	780	814	848	881	913	945	976	1006	1036	1066	1095	1123
	Turns Open	2	1.5	0.5	4.5	4	3	2.5	2	1.5	0.5	0	3	2.5	2	1.5	1
4800	BHP	1.11	1.20	1.28	1.37	1.46	1.56	1.65	1.74	1.84	1.93	2.03	2.13	2.23	2.33	2.43	2.53
	RPM	670	705	740	774	807	840	872	903	934	964	993	1022	1051	1079	1107	1134
	Turns Open	1.5	1	4.5	4	3.5	2.5	2	1.5	1	0.5	3	2.5	2	2	1.5	1
5200	BHP	1.36	1.45	1.55	1.64	1.74	1.84	1.94	2.04	2.14	2.24	2.34	2.45	2.55	2.66	2.77	2.87
	RPM	708	741	773	805	837	867	898	927	957	985	1013	1041	1069	1096	1122	1149
	Turns Open	0.5	4.5	4	3.5	2.5	2	1.5	1	0.5	0	3	2.5	2	1.5	1	0.5
5600	BHP	1.64	1.74	1.84	1.94	2.05	2.15	2.26	2.36	2.47	2.58	2.69	2.80				
	RPM	744	775	806	836	866	895	924	952	980	1007	1034	1061				
	Turns Open	4.5	4	3.5	3	2	1.5	1	0.5	0	3	2.5	2				
6000	BHP	1.95	2.05	2.16	2.27	2.38	2.49	2.60	2.71								
	RPM	777	807	836	865	893	921	948	975								
	Turns Open	4	3.5	3	2	1.5	1	0.5	0								
6400	BHP	2.27	2.38	2.50	2.61	2.73	2.85										
	RPM	807	835	862	890	917	943										
	Turns Open	3.5	3	2.5	1.5	1	0.5										

LEGEND

- **A** — Standard Static Sheave/Standard Motor
- **B** — Low-Static Sheave/Standard Motor
- **C** — High-Static Sheave/Standard Motor
- **ARI** — Air Conditioning and Refrigeration Institute
- **BHP** — Brake Horsepower
- **ESP** — External Static Pressure
- **ISO** — International Organization for Standardization
- **RPM** — Revolutions Per Minute

NOTES:
1. Due to alternate sheaves, 'Turns Open' may vary within ±0.5 turn from the position shown above.
2. Units factory shipped with standard static sheave and drive at 2.5 turns open (5200 cfm at 0.4 in. wg ESP Wet Coil). Other speeds require field selection.
3. ISO/ARI rating point with standard static sheave and drive at 2 turns open (5200 cfm at 0.48 in. wg ESP Wet Coil). Other speeds require field selection.
4. For applications requiring higher static pressures, contact your local representative.
5. Performance data does not include drive losses and is based on sea level conditions.
6. Do not operate in gray region.
7. All airflow is rated at lowest voltage if unit is dual voltage rated, i.e., 208 v for 208-230-v units.
8. For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm]/Face Area [sq ft]). Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg and 500 fpm by 0.16 in. wg.

Table 13 — 50VQL200 Blower Performance Data

RATED CFM		EXTERNAL STATIC PRESSURE (in. wg) 0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
5400	BHP				0.50	0.56	0.63	0.70	0.77	0.84	0.90	0.97	1.03	1.10	1.17	1.23	1.30
	RPM				561	599	635	670	704	736	767	797	826	854	881	907	933
	Turns Open				4.5	3.5	2.5	1.5	4.5	4	3.5	3	2	1.5	1	0.5	0
5800	BHP				0.57	0.63	0.70	0.78	0.86	0.92	0.99	1.06	1.13	1.20	1.26	1.33	1.40
	RPM				576	613	648	682	714	746	776	805	833	861	887	913	938
	Turns Open				4	3	2	1	4.5	4	3	2.5	2	1.5	1	0.5	0
6200	BHP			0.58	0.64	0.71	0.78	0.86	0.94	1.02	1.10	1.19	1.27	1.35	1.43	**1.52**	**1.60**
	RPM			553	590	626	660	693	724	755	784	813	841	868	894	**919**	**944**
	Turns Open			4.5	3.5	2.5	2	1	4.5	3.5	3	2.5	2	1.5	1	**2.5**	**2**
6600	BHP			0.66	0.73	0.80	0.87	0.94	1.02	1.11	1.19	1.28	1.36	**1.45**	**1.53**	**1.62**	**1.70**
	RPM			569	604	638	671	703	734	764	793	821	848	**874**	**900**	**925**	**950**
	Turns Open			4	3	2.5	1.5	4.5	4	3.5	3	2.5	2	**3.5**	**3**	**2.5**	**2**
7000	BHP		0.68	0.75	0.82	0.89	0.96	1.04	1.12	1.21	1.28	1.36	1.44	**1.52**	**1.59**	**1.67**	**1.75**
	RPM		549	584	618	651	683	714	744	773	802	829	856	**882**	**907**	**932**	**956**
	Turns Open		4.5	3.5	3	2	1	4.5	4	3.5	2.5	2	1.5	**3**	**2.5**	**2**	**2**
7400	BHP		0.78	0.85	0.92	0.99	1.07	1.15	1.23	1.31	1.40	**1.48**	**1.55**	**1.63**	**1.70**	**1.78**	
	RPM		566	600	633	665	696	726	755	783	811	**838**	**864**	**889**	**914**	**939**	
	Turns Open		4	3.5	2.5	1.5	1	4	3.5	3	2.5	**4**	**3.5**	**3**	**2.5**	**2**	
7800	BHP	0.82	0.89	0.96	1.03	1.10	1.18	1.26	1.35	1.43	**1.52**	**1.62**	**1.71**	**1.81**			
	RPM	550	584	616	648	679	709	738	766	794	**821**	**847**	**873**	**898**			
	Turns Open	4.5	3.5	3	2	1.5	4.5	4	3.5	3	**4**	**4**	**3.5**	**3**			
8200	BHP	0.93	1.00	1.08	1.15	1.23	1.31	1.39	**1.48**	**1.56**	**1.66**	**1.75**	**1.85**				
	RPM	570	602	633	664	693	722	751	**778**	**805**	**832**	**857**	**883**				
	Turns Open	4	3.5	2.5	1.5	1	4.5	3.5	**5**	**4.5**	**4**	**3.5**	**3**				

LEGEND

- **A** — Standard Static Sheave/Standard Motor
- **B** — Low-Static Sheave/Standard Motor
- **E** — High-Static Sheave/Large Motor
- **ARI** — Air Conditioning and Refrigeration Institute
- **BHP** — Brake Horsepower
- **ESP** — External Static Pressure
- **ISO** — International Organization for Standardization
- **RPM** — Revolutions Per Minute

NOTES:
1. **Bold** numbers require 2 horsepower motor.
2. Values are per blower and motor; 2 blowers and motors required.
3. Due to alternate sheaves, 'Turns Open' may vary within ±0.5 turn from the position shown above.
4. Units factory shipped with standard static sheave and drive at 2.5 turns open (7000 cfm at 0.7 in. wg ESP Wet Coil). Other speeds require field selection.
5. ISO/ARI rating point with standard static sheave and drive at 3.5 turns open (7000 cfm at 0.45 in. wg ESP Wet Coil). Other speeds require field selection.
6. For applications requiring higher static pressures, contact your local representative.
7. Performance data does not include drive losses and is based on sea level conditions.
8. Do not operate in gray region.
9. All airflow is rated at lowest voltage if unit is dual voltage rated, i.e., 208 v for 208-230-v units.
10. For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm]/Face Area [sq ft]). Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg and 500 fpm by 0.16 in. wg.

Table 14 — 50VQL240 Blower Performance Data

RATED CFM		EXTERNAL STATIC PRESSURE (in. wg) 0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
5600	BHP				0.53	0.60	0.67	0.74	0.81	0.87	0.94	1.01	1.08	1.15	1.21	1.28	1.35
	RPM				569	606	642	676	709	741	771	801	830	857	884	910	936
	Turns Open				4	3	2.5	1.5	4.5	4	3.5	2.5	2	1.5	1	0.5	0
6000	BHP			0.54	0.60	0.67	0.74	0.82	0.89	0.98	1.06	1.16	1.22	1.29	1.36	1.43	1.50
	RPM			546	583	619	654	687	719	750	780	809	837	864	891	916	941
	Turns Open			4.5	4	3	2	1	4.5	4	3	2.5	2	1.5	1	0.5	0
6400	BHP			0.62	0.68	0.75	0.82	0.90	0.98	1.06	1.15	1.24	1.34	1.43	1.51	1.58	1.65
	RPM			561	597	632	666	698	729	759	789	817	844	871	897	922	947
	Turns Open			4.5	3.5	2.5	1.5	1	4	3.5	3	2.5	2	1.5	1	0.5	0
6800	BHP			0.70	0.77	0.84	0.91	0.99	1.07	1.16	1.24	1.33	1.42	1.50	1.58	1.67	1.75
	RPM			576	611	645	677	709	739	769	797	825	852	878	904	929	953
	Turns Open			4	3	2	1.5	4.5	4	3.5	3	2.5	1.5	1	0.5	0	2
7200	BHP		0.73	0.80	0.87	0.94	1.01	1.09	1.17	1.26	1.35	1.44	1.53	1.63	1.69	1.74	1.80
	RPM		557	592	625	658	689	720	750	778	806	833	860	886	911	935	959
	Turns Open		4.5	3.5	2.5	2	1	4.5	4	3	2.5	2	1.5	1	0.5	0	2
7600	BHP		0.83	0.90	0.97	1.05	1.12	1.20	1.29	1.37	1.46	1.55	1.65	1.75	**1.85**	**1.95**	**2.06**
	RPM		575	608	640	672	702	732	760	788	816	842	868	894	**918**	**943**	**966**
	Turns Open		4	3	2.5	1.5	4.5	4	3.5	3	2.5	2	1.5	1	**0.5**	**2**	**1.5**
8000	BHP	0.87	0.94	1.01	1.09	1.16	1.24	1.33	1.41	1.50	1.59	1.68	1.78	**1.88**	**1.98**	**2.08**	**2.19**
	RPM	560	593	624	656	686	715	744	772	799	826	852	878	**902**	**927**	**951**	**974**
	Turns Open	4.5	3.5	2.5	2	1	4.5	4	3.5	3	2	1.5	1	**0.5**	**2.5**	**2**	**1.5**
8400	BHP	0.99	1.07	1.14	1.22	1.29	1.38	1.46	1.55	1.63	1.73	1.82	**1.92**	**2.02**	**2.12**	**2.23**	**2.34**
	RPM	580	611	642	672	701	729	757	785	811	837	863	**888**	**912**	**936**	**960**	**983**
	Turns Open	4	3	2.5	1.5	4.5	4	3.5	3	2.5	2	1.5	**1**	**2.5**	**2**	**2**	**1.5**
8800	BHP	1.13	1.20	1.28	1.36	1.44	1.52	1.61	1.69	1.79	**1.88**	**1.98**	**2.07**	**2.17**	**2.28**	**2.39**	**2.49**
	RPM	601	631	660	689	717	745	772	798	824	**850**	**875**	**899**	**923**	**947**	**970**	**993**
	Turns Open	3.5	2.5	2	1	4.5	4	3.5	3	2.5	**2**	**3.5**	**3**	**2.5**	**2**	**1.5**	**1**
9200	BHP	1.27	1.35	1.43	1.51	1.59	1.68	1.77	**1.86**	**1.95**	**2.05**	**2.14**	**2.25**	**2.35**	**2.45**	**2.56**	**2.67**
	RPM	623	652	680	707	734	761	787	**813**	**839**	**864**	**888**	**912**	**936**	**959**	**981**	**1003**
	Turns Open	2.5	2	1.5	4.5	4	3.5	3	**2.5**	**4**	**3.5**	**3**	**2.5**	**2**	**2**	**1.5**	**1**

LEGEND

A — Standard Static Sheave/Standard Motor
B — Low-Static Sheave/Standard Motor
C — High-Static Sheave/Standard Motor
E — High-Static Sheave/Large Motor
ARI — Air Conditioning and Refrigeration Institute
BHP — Brake Horsepower
ESP — External Static Pressure
ISO — International Organization for Standardization
RPM — Revolutions Per Minute

NOTES:
1. Bold numbers require 3 horsepower motor.
2. Values are per blower and motor; 2 blower and motors required.
3. Due to alternate sheaves, 'Turns Open' may vary within ±0.5 turn from the position shown above.
4. Units factory shipped with standard static sheave and drive at 2.5 turns open (8000 cfm at 0.5 in. wg ESP Wet Coil). Other speeds require field selection.
5. ISO/ARI rating point with standard static sheave and drive at 2 turns open (8000 cfm at 0.6 in. wg ESP Wet Coil). Other speeds require field selection.
6. For applications requiring higher static pressures, contact your local representative.
7. Performance data does not include drive losses and is based on sea level conditions.
8. Do not operate in gray region.
9. All airflow is rated at lowest voltage if unit is dual voltage rated, i.e., 208 v for 208-230-v units.
10. For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm]/Face Area [sq ft]). Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg and 500 fpm by 0.16 in. wg.

Table 15 — 50VQL300 Blower Performance Data

RATED CFM		EXTERNAL STATIC PRESSURE (in. wg) 0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
7,400	BHP						1.25	1.33	1.42	1.52	1.61	1.71	1.81	1.92	2.03	2.14	2.25
	RPM						761	789	817	843	869	895	920	944	968	991	1014
	Turns Open						4.5	3.5	3	2.5	2	1.5	0.5	0	2.5	2	1.5
7,800	BHP					1.31	1.40	1.49	1.58	1.67	1.77	1.87	1.97	2.08	2.19	2.30	2.42
	RPM					755	783	810	837	862	888	913	937	961	984	1007	1029
	Turns Open					4.5	4	3	2.5	2	1.5	1	0.5	0	2.5	1.5	1
8,200	BHP				1.39	1.47	1.56	1.65	1.74	1.84	1.94	2.04	2.15	2.25	2.37	2.48	2.60
	RPM				749	777	804	830	856	881	906	930	954	977	1000	1022	1044
	Turns Open				4.5	4	3.5	3	2	1.5	1	0.5	0	2.5	2	1.5	1
8,600	BHP				1.55	1.64	1.73	1.82	1.92	2.02	2.12	2.22	2.33	2.44	2.55	2.67	2.78
	RPM				771	798	824	849	875	899	923	947	970	993	1015	1037	1058
	Turns Open				4	3.5	3	2.5	2	1	0.5	0	2.5	2	1.5	1	0.5
9,000	BHP			1.64	1.73	1.82	1.91	2.01	2.11	2.21	2.31	2.41	2.52	2.63	2.75		
	RPM			766	792	818	843	868	893	917	941	964	986	1008	1030		
	Turns Open			4.5	3.5	3	2.5	2	1.5	1	0.5	2.5	2	1.5	1		
9,400	BHP		1.74	1.83	1.92	2.01	2.10	2.20	2.30	2.41	2.51	2.62	2.73	2.84			
	RPM		761	787	813	838	863	887	911	935	958	980	1002	1024			
	Turns Open		4.5	4	3	2.5	2	1.5	1	0.5	0	2.5	2	1.5			
9,800	BHP	1.84	1.93	2.02	2.12	2.21	2.31	2.41	2.51	2.62	2.72	2.83					
	RPM	757	783	808	833	858	882	906	929	952	974	996					
	Turns Open	4.5	4	3.5	2.5	2	1.5	1	0.5	0	2.5	2					
10,200	BHP	2.04	2.14	2.23	2.33	2.43	2.53	2.63	2.73								
	RPM	779	804	829	853	877	901	924	947								
	Turns Open	4	3.5	3	2.5	1.5	1	0.5	0								
10,600	BHP	2.26	2.36	2.45	2.55	2.65	2.76	2.86									
	RPM	801	825	849	873	896	919	942									
	Turns Open	3.5	3	2.5	2	1.5	1	0									

LEGEND

A — Standard Static Sheave/Standard Motor
C — High-Static Sheave/Large Motor
ARI — Air Conditioning and Refrigeration Institute
BHP — Brake Horsepower
ESP — External Static Pressure
ISO — International Organization for Standardization
RPM — Revolutions Per Minute

NOTES:
1. Values are per blower and motor; 2 blower and motors required.
2. Due to alternate sheaves, 'Turns Open' may vary within ±0.5 turn from the position shown above.
3. Units factory shipped with standard static sheave and drive at 2.5 turns open (9000 cfm at 0.4 in. wg ESP Wet Coil). Other speeds require field selection.
4. ISO/ARI rating point with standard static sheave and drive at 2 turns open (9000 cfm at 0.42 in. wg ESP Wet Coil). Other speeds require field selection.
5. For applications requiring higher static pressures, contact your local representative.
6. Performance data does not include drive losses and is based on sea level conditions.
7. Do not operate in gray region.
8. All airflow is rated at lowest voltage if unit is dual voltage rated, i.e., 208 v for 208-230-v units.
9. For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm]/Face Area [sq ft]). Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg and 500 fpm by 0.16 in. wg.

Table 16 — 50VQL Unit Blower Performance with Modulating Hot Water Reheat

COIL FACE VELOCITY FPM	UNITS WITH HWR - ESP LOSS		
	080 and 160 in. wg	100 - 120 and 200 - 240 in. wg	300 in. wg
200	0.04	—	—
250	0.06	0.02	—
300	0.08	0.05	0.14
350	0.12	0.10	0.17
400	0.15	0.15	0.23
450	0.18	0.23	0.28
500	0.22	0.30	0.34
550	—	0.38	0.41
600	—	0.46	0.49
650	—	—	0.60

LEGEND
ESP — External Static Pressure
HWR — Hot Water Reheat

NOTE: For units with HWR option, calculate the coil face velocity of the entering air. From the table above, find ESP loss for the unit and velocity. This loss includes wet coil loss.

FIELD SELECTABLE INPUTS

Jumpers and DIP (dual in-line package) switches on the control board are used to customize unit operation and can be configured in the field.

IMPORTANT: Jumpers and DIP switches should only be clipped when power to control board has been turned off.

Complete C Control Jumper Settings (See Fig. 8A, 9A, and 10A)

WATER COIL FREEZE PROTECTION (FP1) LIMIT SETTING — Select jumper 3, (JW3-FP1 Low Temp) to choose FP1 limit of 10 F or 30 F. To select 30 F as the limit, DO NOT clip the jumper. To select 10 F as the limit, clip the jumper.

AIR COIL FREEZE PROTECTION (FP2) LIMIT SETTING — Select jumper 2 (JW2-FP2 Low Temp) to choose FP2 limit of 10 F or 30 F. To select 30 F as the limit, DO NOT clip the jumper. To select 10 F as the limit, clip the jumper.

ALARM RELAY SETTING — Select jumper 1 (JW1-AL2 Dry) for connecting alarm relay terminal (AL2) to 24 vac (R) or to remain as a dry contact (no connection). To connect AL2 to R, do not clip the jumper. To set as dry contact, clip the jumper.

Complete C Control DIP Switches — The Complete C Control has 1 DIP switch block with five switches. See Fig. 8A, 9A, and 10A.

PERFORMANCE MONITOR (PM) — DIP switch 1 will enable or disable this feature. To enable the PM, set the switch to ON. To disable the PM, set the switch to OFF.

STAGE 2 — DIP switch 2 will enable or disable compressor delay. Set DIP switch to OFF for stage 2 in which the compressor will have a 3-second delay before energizing.

NOTE: The alarm relay will not cycle during Test mode if switch is set to OFF, stage 2.

DIP SWITCH 3 — not used.

DIP SWITCH 4 — not used.

DIP SWITCH 5 — DIP switch 5 is used to initiate 1 or 3 tries for the FP1 fault. If water freeze protection for the water coil then DIP switch 5 can be set to lockout on the FP1 fault after one try.

Deluxe D Control Jumper Settings (See Fig. 8B, 9B, and 10B)

WATER COIL FREEZE PROTECTION (FP1) LIMIT SETTING — Select jumper 3, (JW3-FP1 Low Temp) to choose FP1 limit of 10 F or 30 F. To select 30 F as the limit, DO NOT clip the jumper. To select 10 F as the limit, clip the jumper.

AIR COIL FREEZE PROTECTION (FP2) LIMIT SETTING — Select jumper 2 (JW2-FP2 Low Temp) to choose FP2 limit of 10 F or 30 F. To select 30 F as the limit, DO NOT clip the jumper. To select 10 F as the limit, clip the jumper.

ALARM RELAY SETTING — Select jumper 4 (JW4-AL2 Dry) for connecting alarm relay terminal (AL2) to 24 vac (R) or to remain as a dry contact (no connection). To connect AL2 to R, do not clip the jumper. To set as dry contact, clip the jumper.

LOW PRESSURE SETTING — The Deluxe D Control can be configured for Low Pressure Setting (LP). Select jumper 1 (JW1-LP Norm Open) for choosing between low pressure input normally opened or closed. To configure for normally closed operation, do not clip the jumper. To configure for normally open operation, clip the jumper.

Deluxe D Control DIP Switches — The Deluxe D Control has 2 DIP switch blocks. Each DIP switch block has 8 switches and is labeled either S1 or S2 on the circuit board. See Fig. 8B, 9B and 10B.

DIP SWITCH BLOCK 1 (S1) — This set of switches offers the following options for Deluxe D Control configuration:

Performance Monitor (PM) — Set switch 1 to enable or disable performance monitor. To enable the PM, set the switch to ON. To disable the PM, set the switch to OFF.

Compressor Relay Staging Operation — Switch 2 will enable or disable compressor relay staging operation. The compressor relay can be set to turn on with stage 1 or stage 2 call from the thermostat. This setting is used with dual stage units (units with 2 compressors and 2 Deluxe D controls) or in master/slave applications. In master/slave applications, each compressor and fan will stage according to its switch 2 setting. If switch is set to stage 2, the compressor will have a 3-second delay before energizing during stage 2 demand.

NOTE: If DIP switch is set for stage 2, the alarm relay will not cycle during Test mode.

Heating/Cooling Thermostat Type — Switch 3 provides selection of thermostat type. Heat pump or heat/cool thermostats can be selected. Select OFF for heat/cool thermostats. When in

heat/cool mode, Y1 is used for cooling stage 1, Y2 is used for cooling stage 2, W1 is used for heating stage 1 and O/W2 is used for heating stage 2. Select ON for heat pump applications. In heat pump mode, Y1 used is for compressor stage 1, Y2 is used for compressor stage 2, W1 is used for heating stage 3 or emergency heat, and O/W2 is used for RV (heating or cooling) depending upon switch 4 setting.

O/B Thermostat Type — Switch 4 provides selection for heat pump O/B thermostats. O is cooling output. B is heating output. Select ON for heat pumps with O output. Select OFF for heat pumps with B output.

Dehumidification Fan Mode — Switch 5 provides selection of normal or dehumidification fan mode. Select OFF for dehumidification mode. The fan speed relay will remain OFF during cooling stage 2. Select ON for normal mode. The fan speed relay will turn on during cooling stage 2 in normal mode.

Switch 6 — Not used.

Boilerless Operation — Switch 7 provides selection of boilerless operation and works in conjunction with switch 8. In boilerless operation mode, only the compressor is used for heating when FP1 is above the boilerless changeover temperature set by switch 8 below. Select ON for normal operation or select OFF for boilerless operation.

Boilerless Changeover Temperature — Switch 8 on S1 provides selection of boilerless changeover temperature set point. Select OFF for set point of 50 F or select ON for set point of 40 F.

If switch 8 is set for 50 F, then the compressor will be used for heating as long as the FP1 is above 50 F. The compressor will not be used for heating when the FP1 is below 50 F and the compressor will operate in emergency heat mode, staging on EH1 and EH2 to provide heat. If a thermal switch is being used instead of the FP1 thermistor, only the compressor will be used for heating mode when the FP1 terminals are closed. If the FP1 terminals are open, the compressor is not used and the control goes into emergency heat mode.

DIP SWITCH BLOCK 2 (S2) — This set of DIP switches is used to configure accessory relay options. See Fig. 8B, 9B and 10B.

Switches 1 to 3 — These DIP switches provide selection of Accessory 1 relay options. See Table 17 for DIP switch combinations.

Switches 4 to 6 — These DIP switches provide selection of Accessory 2 relay options. See Table 18 for DIP switch combinations.

Auto Dehumidification Mode or High Fan Mode — Switch 7 provides selection of auto dehumidification fan mode or high fan mode. In auto dehumidification fan mode the fan speed relay will remain off during cooling stage 2 if terminal H is active. In high fan mode, the fan enable and fan speed relays will turn on when terminal H is active. Set the switch to ON for auto dehumidification fan mode or to OFF for high fan mode.

Switch 8 — Not used.

Table 17 — DIP Switch Block S2 — Accessory 1 Relay Options

ACCESSORY 1 RELAY OPTIONS	DIP SWITCH POSITION		
	1	2	3
Cycle with Fan	On	On	On
Digital NSB	Off	On	On
Water Valve — Slow Opening	On	Off	On
OAD	On	On	Off

LEGEND

NSB — Night Setback
OAD — Outside Air Damper

NOTE: All other DIP switch combinations are invalid.

Table 18 — DIP Switch Block S2 — Accessory 2 Relay Options

ACCESSORY 2 RELAY OPTIONS	DIP SWITCH POSITION		
	4	5	6
Cycle with Fan	On	On	On
Digital NSB	Off	On	On
Water Valve — Slow Opening	On	Off	On
OAD	On	On	Off

LEGEND

NSB — Night Setback
OAD — Outside Air Damper

NOTE: All other switch combinations are invalid.

Units with Modulating Hot Water Reheat (HWR) Option — A heat pump equipped with Hot Water Reheat (HWR) can operate in three modes: cooling, cooling with reheat, and heating. The cooling/heating modes are like any other Aquazone™ water source heat pump. The reversing valve ("O" signal) is energized in cooling, along with the compressor contactor(s) and blower relay. In the heating mode, the reversing valve is deenergized. Almost any thermostat will activate the heat pump in heating or cooling modes. The Deluxe D microprocessor board, which is standard with the HWR option, will accept either heat pump (Y,O) thermostats or non-heat pump (Y,W) thermostats.

The reheat mode requires either a separate humidistat/dehumidistat or a thermostat that has an integrated dehumidification function for activation. The Deluxe D board is configured to work with either a humidistat or dehumidistat input to terminal "H" (DIP switch settings for the Deluxe D board are shown in Table 19). Upon receiving an "H" input, the Deluxe D board will activate the cooling mode and engage reheat.

Table 19 — Humidistat/Dehumidistat Logic and Deluxe D DIP Switch Settings

Sensor	2.1	2.2	2.3	Logic	Reheat (ON) - H	Reheat (OFF) - H
Humidistat	Off	Off	Off	Reverse	0 VAC	24 VAC
Dehumidistat	Off	On	Off	Standard	24 VAC	0 VAC

Table 20 shows the relationship between thermostat input signals and unit operation. There are four operational inputs for single-stage units and six operational inputs for dual-stage units:

- Fan Only
- Cooling Stage 1
- Cooling Stage 2
- Heating Stage 1
- Heating Stage 2
- Reheat Mode

HWR APPLICATION CONSIDERATIONS — Unlike most hot gas reheat options, the HWR option will operate over a wide range of entering-water temperatures (EWTs). Special flow regulation (water regulating valve) is not required for low EWT conditions. However, below 55 F, supply-air temperatures cannot be maintained at 72 F because the cooling capacity exceeds the reheat coil capacity at low water temperatures. Below 55 F, essentially all water is diverted to the reheat coil (no heat of rejection to the building loop). Although the HWR option will work fine with low EWTs, overcooling of the space may result with well water systems or, on rare occasions, with ground loop (geothermal) systems (NOTE: Extended range units are required for well water and ground loop systems). Since dehumidification is generally only required in cooling, most ground loop systems will not experience overcooling of the supply-air temperature. If overcooling of the space is a concern (e.g., computer room well water application), auxiliary heating may be required to maintain space temperature when

the unit is operating in the dehumidification mode. Water source heat pumps with HWR should not be used as makeup air units. These applications should use equipment specifically designed for makeup air.

HWR COMPONENT EFUNCTIONS — The proportional controller operates on 24 VAC power supply and automatically adjusts the water valve based on the supply-air sensor. The supply-air sensor senses supply-air temperature at the blower inlet, providing the input signal necessary for the proportional control to drive the motorized valve during the reheat mode of operation. The motorized valve is a proportional actuator/three-way valve combination used to divert the condenser water from the coax to the hydronic reheat coil during the reheat mode of operation. The proportional controller sends a signal to the motorized valve based on the supply-air temperature reading from the supply-air sensor.

The loop pump circulates condenser water through the hydronic reheat coil during the reheat mode of operation (refer to Fig. 15). In this application, the loop pump is only energized during the reheat mode of operation. The hydronic coil is utilized during the reheat mode of operation to reheat the air to the set point of the proportional controller. Condenser water is diverted by the motorized valve and pumped through the hydronic coil by the loop pump in proportion to the control set point. The amount of reheating is dependent on the set point and how far from the set point the supply-air temperature is. The factory set point is 70 to 75 F, generally considered "neutral" air.

Deluxe D Control Accessory Relay Configurations — The following accessory relay settings are applicable for both Deluxe D controls only:

CYCLE WITH FAN — In this configuration, the relay will be ON any time the Fan Enable relay is on.

CYCLE WITH COMPRESSOR — In this configuration, the relay will be ON any time the Compressor relay is on.

DIGITAL NIGHT SET BACK (NSB) — In this configuration, the relay will be ON if the NSB input is connected to ground C.

NOTE: If there are no relays configured for digital NSB, then the NSB and override (OVR) inputs are automatically configured for mechanical operation.

MECHANICAL NIGHT SET BACK — When NSB input is connected to ground C, all thermostat inputs are ignored. A thermostat set back heating call will then be connected to the OVR input. If OVR input becomes active, then the Deluxe D control will enter Night Low Limit (NLL) staged heating mode. The NLL staged heating mode will then provide heating during the NSB period.

WATER VALVE (SLOW OPENING) — If relay is configured for Water Valve (slow opening), the relay will start 60 seconds prior to starting compressor relay.

OUTSIDE AIR DAMPER (OAD) — If relay is configured for OAD, the relay will normally be ON any time the Fan Enable relay is energized. The relay will not start for 30 minutes following a return to normal mode from NSB, when NSB is no longer connected to ground C. After 30 minutes, the relay will start if the Fan Enable is set to ON.

Table 20 — HWR Operating Modes

MODE	INPUT					OUTPUT				
	O	G	Y1	Y2*	H	O	G	Y1	Y2*	Reheat
No Demand	On/Off	Off	Off	Off	Off	On/Off	Off	Off	Off	Off
Fan Only	On/Off	On	Off	Off	Off	On/Off	On	Off	Off	Off
Cooling Stage 1	On	On	On	Off	Off	On	On	On	Off	Off
Cooling Stage 2	On	On	On	On	Off	On	On	On	On	Off
Cooling and Dehumidistat†	On	On	On	On/Off	On	On	On	On	On/Off	Off
Dehumidistat Only	On/Off	Off	Off	Off	On	On	On	On	On	On
Heating Stage 1	Off	On	On	Off	Off	Off	On	On	Off	Off
Heating Stage 2	Off	On	On	On	Off	Off	On	On	On	Off
Heating and Dehumidistat**	Off	On	On	On/Off	On	Off	On	On	On/Off	Off

*Not applicable for single-stage units; Full load operation for dual-capacity units.
†Cooling input takes priority over dehumidify input.
**Deluxe D is programmed to ignore the H demand when the unit is in heating mode.
NOTE: On/Off is either on or off.

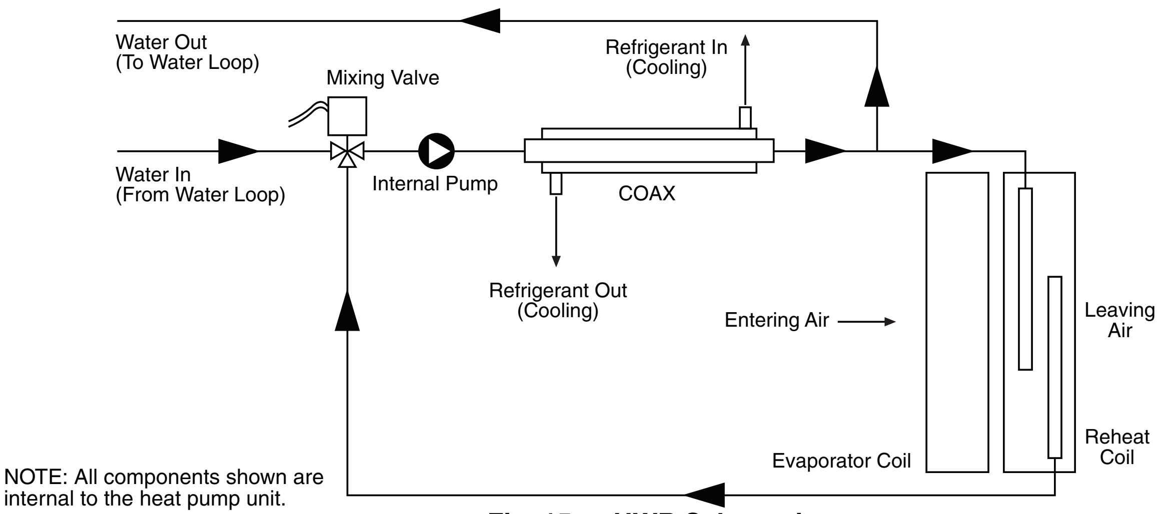


Fig. 15 — HWR Schematic

⚠ CAUTION

To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless antifreeze is added to system water. Condenser coils never fully drain by themselves and will freeze unless winterized with antifreeze.

START-UP

Use the procedure outlined below to initiate proper unit start-up.

NOTE: This equipment is designed for indoor installation only.

Operating Limits

ENVIRONMENT — This equipment is designed for indoor installation ONLY. Extreme variations in temperature, humidity and corrosive water or air will adversely affect the unit performance, reliability and service life.

POWER SUPPLY — A voltage variation of ± 10% of nameplate utilization voltage is acceptable.

UNIT STARTING CONDITIONS — All units start and operate in an ambient of 45 F with entering-air at 40 F, entering-water at 20 F and with both air and water at the flow rates used.

NOTE: These operating conditions are not normal or continuous operating conditions. It is assumed that such a start-up is for the purpose of bringing the building space up to occupancy temperature.

⚠ WARNING

When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with the energized equipment.

Start Up System

1. Restore power to system.
2. Turn thermostat fan position to ON. Blower should start.
3. Balance airflow at registers.
4. Adjust all valves to the full open position and turn on the line power to all heat pump units.
5. Operate unit in the cooling cycle. Room temperature should be approximately 45 to 100 F dry bulb. Loop water temperature entering the heat pumps should be between 40 and 90 F.

NOTE: Three factors determine the operating limits of a unit: (1) entering-air temperature, (2) water temperature and (3) ambient temperature. Whenever any of these factors are at a minimum or maximum level, the other two factors must be at a normal level to ensure proper unit operation. See Table 21.

Table 21 — 50HQL,VQL Units Operating Limits

AIR LIMITS	COOLING (F)	HEATING (F)
Min. Ambient Air	45	45
Rated Ambient Air	80	70
Max. Ambient Air	100	85
Min. Ent. Air	50	40
Normal Entering Air db/wb	75/63-80/67	70
Max. Entering Air db/wb	110/83	80
WATER LIMITS		
Min. Entering Water	*30	45 (*20)
Normal Entering Water	40-90	40-90
Max. Entering Water	110	90

LEGEND

db — Dry Bulb
wb — Wet Bulb

*With antifreeze, optional extended range insulation and low temperature cutout jumper clipped for antifreeze.

Scroll Compressor Rotation — It is important to be certain compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gages to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

If the suction pressure does not drop and the discharge pressure does not rise to normal levels:

1. Turn off power to the unit. Install disconnect tag.
2. Reverse any two of the unit power leads.
3. Reapply power to the unit and verify pressures are correct.

The suction and discharge pressure levels should now move to their normal start-up levels.

When the compressor is rotating in the wrong direction, the unit makes an elevated level of noise and does not provide cooling.

After a few minutes of reverse operation, the scroll compressor internal overload protection will open, thus activating the unit lockout. This requires a manual reset. To reset, turn the thermostat on and then off.

NOTE: There is a 5-minute time delay before the compressor will start.

Unit Start-Up Cooling Mode

1. Adjust the unit thermostat to the warmest position. Slowly reduce the thermostat position until the compressor activates.
2. Check for cool air delivery at unit grille a few minutes after the unit has begun to operate.
3. Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using P/T plugs. Check the elevation and cleanliness of the condensate lines; any dripping could be a sign of a blocked line. Be sure the condensate trap includes a water seal.
4. Check the temperature of both supply and discharge water.
5. Air temperature drop across the coil should be checked when compressor is operating. Air temperature drop should be between 15 and 25 F.

Unit Start-Up Heating Mode

NOTE: Operate the unit in heating cycle after checking the cooling cycle. Allow 5 minutes between tests for the pressure or reversing valve to equalize.

1. Turn thermostat to lowest setting and set thermostat switch to HEAT position.
2. Slowly turn the thermostat to a higher temperature until the compressor activates.
3. Check for warm air delivery at the unit grille within a few minutes after the unit has begun to operate.
4. Check the temperature of both supply and discharge water.
5. Air temperature rise across the coil should be checked when compressor is operating. Air temperature rise should be between 20 and 30 F after 15 minutes at load.
6. Check for vibration, noise and water leaks.

Flow Regulation — Flow regulation can be accomplished by two methods. Most water control valves have a flow adjustment built into the valve. By measuring the pressure drop through the unit heat exchanger, the flow rate can be determined. Adjust the water control valve until the flow of 1.5 to 2 gpm is achieved. Since the pressure constantly varies, two pressure gages may be needed in some applications.

An alternative method is to install a flow control device. These devices are typically an orifice of plastic material designed to allow a specified flow rate that are mounted on the outlet of the water control valve. Occasionally these valves produce a velocity noise that can be reduced by applying some back pressure. To accomplish this, slightly close the leaving isolation valve of the well water setup.

⚠ WARNING

To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position before flushing system.

Flushing — Once the piping is complete, final purging and loop charging is needed. A flush cart pump of at least 1.5 hp is needed to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop. Flush the loop in both directions with a high volume of water at a high velocity. Follow the steps below to properly flush the loop:

1. Verify power is off.
2. Fill loop with water from hose through flush cart before using flush cart pump to ensure an even fill. Do not allow the water level in the flush cart tank to drop below the pump inlet line to prevent air from filling the line.
3. Maintain a fluid level in the tank above the return tee to avoid air entering back into the fluid.
4. Shutting off the return valve that connects into the flush cart reservoir will allow 50 psi surges to help purge air pockets. This maintains the pump at 50 psi.
5. To purge, keep the pump at 50 psi until maximum pumping pressure is reached.
6. Open the return valve to send a pressure surge through the loop to purge any air pockets in the piping system.
7. A noticeable drop in fluid level will be seen in the flush cart tank. This is the only indication of air in the loop.

NOTE: If air is purged from the system while using a 10 in. PVC flush tank, only a 1 to 2 in. level drop will be noticed since liquids are incompressible. If the level drops more than this, flushing should continue since air is still being compressed in the loop. If level is less than 1 to 2 in., reverse the flow.

8. Repeat this procedure until all air is purged.
9. Restore power.

Antifreeze may be added before, during or after the flushing process. However, depending on when it is added in the process, it can be wasted. Refer to the Antifreeze section for more detail.

Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the warmer months. This fluctuation is normal and should be considered when charging the system initially. Run the unit in either heating or cooling for several minutes to condition the loop to a homogenous temperature.

When complete, perform a final flush and pressurize the loop to a static pressure of 40 to 50 psi for winter months or 15 to 20 psi for summer months.

After pressurization, be sure to remove the plug from the end of the loop pump motor(s) to allow trapped air to be discharged and to ensure the motor housing has been flooded. Be sure the loop flow center provides adequate flow through the unit by checking pressure drop across the heat exchanger.

Antifreeze — In areas where entering loop temperatures drop below 40 F or where piping will be routed through areas subject to freezing, antifreeze is needed.

Alcohols and glycols are commonly used as antifreeze agents. Freeze protection should be maintained to 15 F below the lowest expected entering loop temperature. For example, if the lowest expected entering loop temperature is 30 F, the leaving loop temperature would be 22 to 25 F. Therefore, the freeze protection should be at 15 F (30 F – 15 F = 15 F).

IMPORTANT: All alcohols should be pre-mixed and pumped from a reservoir outside of the building or introduced under water level to prevent alcohols from fuming.

Calculate the total volume of fluid in the piping system. See Table 22. Use the percentage by volume in Table 23 to determine the amount of antifreeze to use. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

FREEZE PROTECTION SELECTIONThe 30 F FP1 factory setting (water) should be used to avoid freeze damage to the unit.

Once antifreeze is selected, the JW3 jumper (FP1) should be clipped on the control to select the low temperature (antifreeze 13 F) set point to avoid nuisance faults.

Table 22 — Approximate Fluid Volume (gal.) per 100 Ft of Pipe

PIPE	DIAMETER (in.)	VOLUME (gal.)
Copper	1 1.25 1.5	4.1 6.4 9.2
Rubber Hose	1	3.9
Polyethylene	3/4 IPS SDR11 1 IPS SDR11 1 1/4 IPS SDR11 1/2 IPS SDR11 2 IPS SDR11 1 1/4 IPS SCH40 1 1/2 IPS SCH40 2 IPS SCH40	2.8 4.5 8.0 10.9 18.0 8.3 10.9 17.0

LEGEND

IPS — Internal Pipe Size
SCH — Schedule
SDR — Standard Dimensional Ratio

NOTE: Volume of heat exchanger is approximately 1.0 gallon.

Table 23 — Antifreeze Percentages by Volume

ANTIFREEZE	MINIMUM TEMPERATURE FOR FREEZE PROTECTION (F)			
	10	15	20	25
Methanol (%)	25	21	16	10
100% USP Food Grade Propylene Glycol (%)	38	30	22	15
Ethanol (%)	29	25	20	14

Cooling Tower/Boiler Systems — These systems typically use a common loop maintained at 60 to 90 F. The use of a closed circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop is recommended. If an open type cooling tower is used continuously, chemical treatment and filtering will be necessary.

Ground Coupled, Closed Loop and Plateframe Heat Exchanger Well Systems — These systems allow water temperatures from 30 to 110 F. The external loop field is divided up into 2 in. polyethylene supply and return lines. Each line has valves connected in such a way that upon system start-up, each line can be isolated for flushing using only the system pumps. Air separation should be located in the piping system prior to the fluid re-entering the loop field.

OPERATION

Power Up Mode — The unit will not operate until all the inputs, terminals and safety controls are checked for normal operation.

NOTE: The compressor will have a 5-minute anti-short cycle upon power up.

Units with Aquazone™ Complete C Control

STANDBY — Y and W terminals are not active in Standby mode, however the O and G terminals may be active, depending on the application. The compressor will be off.

COOLING — Y and O terminals are active in Cooling mode. After power up, the first call to the compressor will initiate a 5 to 80 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energized.

NOTE: On all subsequent compressor calls the random start delay is omitted.

HEATING STAGE 1 — Terminal Y is active in heating stage 1. After power up, the first call to the compressor will initiate a 5 to 80 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energized.

NOTE: On all subsequent compressor calls the random start delay is omitted.

HEATING STAGE 2 — To enter Stage 2 mode, terminal W is active (Y is already active). Also, the G terminal must be active or the W terminal is disregarded. The compressor relay will remain on and EH1 is immediately turned on. EH2 will turn on after 10 minutes of continual stage 2 demand.

NOTE: EH2 will not turn on (or if on, will turn off) if FP1 temperature is greater than 45 F and FP2 is greater than 110 F.

EMERGENCY HEAT — In emergency heat mode, terminal W is active while terminal Y is not. Terminal G must be active or the W terminal is disregarded. EH1 is immediately turned on. EH2 will turn on after 5 minutes of continual emergency heat demand.

Units with Aquazone Deluxe D Control

STANDBY/FAN ONLY — The compressor will be off. The Fan Enable, Fan Speed, and reversing valve (RV) relays will be on if inputs are present. If there is a Fan 1 demand, the Fan Enable will immediately turn on. If there is a Fan 2 demand, the Fan Enable and Fan Speed will immediately turn on.

NOTE: DIP switch 5 on S1 does not have an effect upon Fan 1 and Fan 2 outputs.

HEATING STAGE 1 — In Heating Stage 1 mode, the Fan Enable and Compressor relays are turned on immediately. Once the demand is removed, the relays are turned off and the control reverts to Standby mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will operate per their associated DIP switch 2 setting on S1.

HEATING STAGE 2 — In Heating Stage 2 mode, the Fan Enable and Compressor relays are remain on. The Fan Speed relay is turned on immediately and turned off immediately once the demand is removed. The control reverts to Heating Stage 1 mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will operate per their associated DIP switch 2 setting on S1.

HEATING STAGE 3 — In Heating Stage 3 mode, the Fan Enable, Fan Speed and Compressor relays remain on. The EH1 output is turned on immediately. With continuing Heat Stage 3 demand, EH2 will turn on after 10 minutes. EH1 and EH2 are turned off immediately when the Heating Stage 3 demand is removed. The control reverts to Heating Stage 2 mode.

Output EH2 will be off if FP1 is greater than 45 F AND FP2 (when shorted) is greater than 110 F during Heating Stage 3 mode. This condition will have a 30-second recognition time. Also, during Heating Stage 3 mode, EH1, EH2, Fan Enable, and Fan Speed will be ON if G input is not active.

EMERGENCY HEAT — In Emergency Heat mode, the Fan Enable and Fan Speed relays are turned on. The EH1 output is turned on immediately. With continuing Emergency Heat demand, EH2 will turn on after 5 minutes. Fan Enable and Fan Speed relays are turned off after a 60-second delay. The control reverts to Standby mode.

Output EH1, EH2, Fan Enable, and Fan Speed will be ON if the G input is not active during Emergency Heat mode.

COOLING STAGE 1 — In Cooling Stage 1 mode, the Fan Enable, compressor and RV relays are turned on immediately. If configured as stage 2 (DIP switch set to OFF) then the compressor and fan will not turn on until there is a stage 2 demand. The Fan Enable and compressor relays are turned off immediately when the Cooling Stage 1 demand is removed. The control reverts to Standby mode. The RV relay remains on until there is a heating demand. If there is a master/slave or dual compressor application, all compressor relays and related functions will track with their associated DIP switch 2 on S1.

COOLING STAGE 2 — In Cooling Stage 2 mode, the Fan Enable, compressor and RV relays remain on. The Fan Speed relay is turned on immediately and turned off once the Cooling Stage 2 demand is removed. The control reverts to Cooling Stage 1 mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will track with their associated DIP switch 2 on S1.

NIGHT LOW LIMIT (NLL) STAGED HEATING — In NLL staged Heating mode, the override (OVR) input becomes active and is recognized as a call for heating and the control will immediately go into a Heating Stage 1 mode. With an additional 30 minutes of NLL demand, the control will go into Heating Stage 2 mode. With another additional 30 minutes of NLL demand, the control will go into Heating Stage 3 mode.

Units with HWR Option

FAN ONLY — A (G) call from the thermostat to the (G) terminal of the Deluxe D control board will bring the unit on in fan only mode.

COOLING STAGE 1 — A simultaneous call from (G), (Y1), and (O) to the (G), (Y1), (O/W2) terminals of the Deluxe D control board will bring the unit on in Cooling Stage 1.

COOLING STAGE 2 — A simultaneous call from (G), (Y1), (Y2), and (O) to the (G), (Y1), (Y2), and (O/W2) terminals of the Deluxe D control board will bring the unit on in Cooling Stage 2. When the call is satisfied at the thermostat the unit will continue to run in Cooling Stage 1 until the Cooling Stage 1 call is removed or satisfied, shutting down the unit.

NOTE: Not all units have two-stage cooling functionality.

HEATING STAGE 1 — A simultaneous call from (G) and (Y1) to the (G) and (Y1) terminals of the Deluxe D control board will bring the unit on in Heating Stage 1.

HEATING STAGE 2 — A simultaneous call from (G), (Y1), and (Y2) to the (G), (Y1), and (Y2) terminals of the Deluxe D control board will bring the unit on in Heating

Stage 2. When the call is satisfied at the thermostat the unit will continue to run in Heating Stage 1 until the call is removed or satisfied, shutting down the unit.

NOTE: Not all units have two-stage heating functionality.

REHEAT MODE — A call from the humidistat/dehumidistat to the (H) terminal of the Deluxe D control board will bring the unit on in Reheat mode if there is no call for cooling at the thermostat. When the humidistat/dehumidistat call is removed or satisfied the unit will shut down.

NOTE: Cooling always overrides Reheat mode. In the Cooling mode, the unit cools and dehumidifies. If the cooling thermostat is satisfied but there is still a call for dehumidification, the unit will continue to operate in Reheat mode.

SYSTEM TEST

System testing provides the ability to check the control operation. The control enters a 20-minute Test mode by momentarily shorting the test pins. All time delays are increased 15 times.

Test Mode — To enter Test mode on Complete C or Deluxe D controls, cycle the power 3 times within 60 seconds. The LED (light-emitting diode) will flash a code representing the last fault when entering the Test mode. The alarm relay will also power on and off during Test mode. See Tables 24-26. To exit Test mode, short the terminals for 3 seconds or cycle the power 3 times within 60 seconds.

NOTE: The Deluxe D control has a flashing code and alarm relay cycling code that will both have the same numerical label. For example, flashing code 1 will have an alarm relay cycling code 1. Code 1 indicates the control has not faulted since the last power off to power on sequence.

Retry Mode — In Retry mode, the status LED will start to flash slowly to signal that the control is trying to recover from an input fault. The control will stage off the outputs and try to again satisfy the thermostat used to terminal Y. Once the thermostat input calls are satisfied, the control will continue normal operation.

NOTE: If 3 consecutive faults occur without satisfying the thermostat input call to terminal Y, the control will go into lockout mode. The last fault causing the lockout is stored in memory and can be viewed by entering Test mode.

Aquazone™ Deluxe D Control LED Indicators — There are 3 LED indicators on the Deluxe D control:

STATUS LED — Status LED indicates the current status or mode of the Deluxe D control. The Status LED light is green.

TEST LED — Test LED will be activated any time the Deluxe D control is in Test mode. The Test LED light is yellow.

FAULT LED — Fault LED light is red. The fault LED will always flash a code representing the last fault in memory. If there is no fault in memory, the fault LED will flash code 1 on the and appear as 1 fast flash alternating with a 10-second pause. See Table 26.

Table 24 — Complete C Control Current LED Status and Alarm Relay Operations

LED STATUS	DESCRIPTION OF OPERATION	ALARM RELAY
On	Normal Mode	Open
	Normal Mode with PM Warning	Cycle (closed 5 sec., Open 25 sec.)
Off	Complete C Control is non-functional	Open
Slow Flash	Fault Retry	Open
	Over/Under Voltage Shutdown	Open (Closed after 15 minutes)
Fast Flash	Lockout	Closed
Flashing Code 1	Test Mode — No fault in memory	Cycling Code 1
Flashing Code 2	Test Mode — HP Fault in memory	Cycling Code 2
Flashing Code 3	Test Mode — LP Fault in memory	Cycling Code 3
Flashing Code 4	Test Mode — FP1 Fault in memory	Cycling Code 4
Flashing Code 5	Test Mode — FP2 Fault in memory	Cycling Code 5
Flashing Code 6	Test Mode — CO Fault in memory	Cycling Code 6
Flashing Code 7	Test Mode — Over/Under shutdown in memory	Cycling Code 7
Flashing Code 8	Test Mode — PM in memory	Cycling Code 8
Flashing Code 9	Test Mode — FP1/FP2 Swapped fault in memory	Cycling Code 9

LEGEND

CO — Condensate Overflow
FP — Freeze Protection
HP — High Pressure
LED — Light-Emitting Diode
LP — Low Pressure
PM — Performance Monitor

NOTES:
1. Slow flash is 1 flash every 2 seconds.
2. Fast flash is 2 flashes every 1 second.
3. EXAMPLE: “Flashing Code 2” is represented by 2 fast flashes followed by a 10-second pause. This sequence will repeat continually until the fault is cleared.

Table 25 — Complete C Control LED Code and Fault Descriptions

LED CODE	FAULT	DESCRIPTION
1	No fault in memory	There has been no fault since the last power-down to power-up sequence
2	High-Pressure Switch	HP Open Instantly
3	Low-Pressure Switch	LP open for 30 continuous seconds before or during a call (bypassed for first 60 seconds)
4	Freeze Protection Coax — FP1	FP1 below Temp limit for 30 continuous seconds (bypassed for first 60 seconds of operation)
5	Freeze Protection Air Coil — FP2	FP2 below Temp limit for 30 continuous seconds (bypassed for first 60 seconds of operation)
6	Condensate overflow	Sense overflow (grounded) for 30 continuous seconds
7 (Autoreset)	Over/Under Voltage Shutdown	"R" power supply is <19VAC or >30VAC
8	PM Warning	Performance Monitor Warning has occurred.
9	FP1 and FP2 Thermistors are swapped	FP1 temperature is higher than FP2 in heating/test mode, or FP2 temperature is higher than FP1 in cooling/test mode.

LEGEND

CO — Condensate Overflow
FP — Freeze Protection
HP — High Pressure
LED — Light-Emitting Diode
PM — Performance Monitor

Table 26 — Aquazone™ Deluxe D Control Current LED Status and Alarm Relay Operations

DESCRIPTION	STATUS LED (Green)	TEST LED (Yellow)	FAULT LED (Red)	ALARM RELAY
Normal Mode	On	Off	Flash Last Fault Code in Memory	Open
Normal Mode with PM	On	Off	Flashing Code 8	Cycle (closed 5 sec, open 25 sec, …)
Deluxe D Control is non-functional	Off	Off	Off	Open
Test Mode	—	On	Flash Last Fault Code in Memory	Cycling Appropriate Code
Night Setback	Flashing Code 2	—	Flash Last Fault Code in Memory	—
ESD	Flashing Code 3	—	Flash Last Fault Code in Memory	—
Invalid T-stat Inputs	Flashing Code 4	—	Flash Last Fault Code in Memory	—
No Fault in Memory	On	Off	Flashing Code 1	Open
HP Fault	Slow Flash	Off	Flashing Code 2	Open
LP Fault	Slow Flash	Off	Flashing Code 3	Open
FP1 Fault	Slow Flash	Off	Flashing Code 4	Open
FP2 Fault	Slow Flash	Off	Flashing Code 5	Open
CO Fault	Slow Flash	Off	Flashing Code 6	Open
Over/Under Voltage	Slow Flash	Off	Flashing Code 7	Open (closed after 15 minutes)
HP Lockout	Fast Flash	Off	Flashing Code 2	Closed
LP Lockout	Fast Flash	Off	Flashing Code 3	Closed
FP1 Lockout	Fast Flash	Off	Flashing Code 4	Closed
FP2 Lockout	Fast Flash	Off	Flashing Code 5	Closed
CO Lockout	Fast Flash	Off	Flashing Code 6	Closed

LEGEND

CO — Condensate Overflow
ESD — Emergency Shutdown
FP — Freeze Protection
HP — High Pressure
LP — Low Pressure
PM — Performance Monitor

NOTES:
1. If there is no fault in memory, the Fault LED will flash code 1.
2. Codes will be displayed with a 10-second Fault LED pause.
3. Slow flash is 1 flash every 2 seconds.
4. Fast flash is 2 flashes every 1 second.
5. EXAMPLE: “Flashing Code 2” is represented by 2 fast flashes followed by a 10-second pause. This sequence will repeat continually until the fault is cleared.

SERVICE

Perform the procedures outlined below periodically, as indicated.

> IMPORTANT: When a compressor is removed from this unit, system refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, the refrigerant lines of the compressor must be sealed after it is removed.

> IMPORTANT: All refrigerant discharged from this unit must be recovered without exception. Technicians must follow industry accepted guidelines and all local, state and federal statutes for the recovery and disposal of refrigerants.

> IMPORTANT: To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must only be serviced by technicians which meet local, state and federal proficiency requirements.

> IMPORTANT: To prevent injury or death due to electrical shock or contact with moving parts, open unit disconnect switch before servicing unit.

Filters — Filters must be clean for maximum performance. Inspect filters every month under normal operating conditions. replace when necessary.

> IMPORTANT: Units should never be operated without a filter.

Water Coil — Keep all air out of the water coil. Check open loop systems to be sure the well head is not allowing air to infiltrate the water line. Always keep lines airtight.

Inspect heat exchangers regularly, and clean more frequently if the unit is located in a “dirty” environment. The heat exchanger should be kept full of water at all times. Open loop systems should have an inverted P trap placed in the discharge line to keep water in the heat exchanger during off cycles. Closed loop systems must have a minimum of 15 PSI during the summer and 40 PSI during the winter.

Check P trap frequently for proper operation.

> IMPORTANT: To avoid fouled machinery and extensive unit clean-up, DO NOT operate units without filters in place. DO NOT use equipment as a temporary heat source during construction.

Condensate Drain Pans — Check condensate drain pans for algae growth twice a year. If algae growth is apparent, consult a water treatment specialist for proper chemical treatment. The application of an algaecide every three months will typically eliminate algae problems in most locations.

Refrigerant System — Verify air and water flow rates are at proper levels before servicing. To maintain sealed circuitry integrity, do not install service gauges unless unit operation appears abnormal.

Condensate Drain Cleaning — Clean the drain line and unit drain pan at the start of each cooling season. Check flow by pouring water into drain. Be sure trap is filled to maintain an air seal.

Air Coil Cleaning — Remove dirt and debris from evaporator coil as required by condition of the coil. Clean coil with a stiff brush, vacuum cleaner, or compressed air. Use a fin comb of the correct tooth spacing when straightening mashed or bent coil fins.

Condenser Cleaning — Water-cooled condensers may require cleaning of scale (water deposits) due to improperly maintained closed-loop water systems. Sludge build-up may need to be cleaned in an open water tower system due to induced contaminants.

Local water conditions may cause excessive fouling or pitting of tubes. Condenser tubes should therefore be cleaned at least once a year, or more often if the water is contaminated.

Proper water treatment can minimize tube fouling and pitting. If such conditions are anticipated, water treatment analysis is recommended. Refer to the Carrier System Design Manual, Part 5, for general water conditioning information.

⚠ CAUTION

Follow all safety codes. Wear safety glasses and rubber gloves when using inhibited hydrochloric acid solution. Observe and follow acid manufacturer's instructions. Failure to follow these safety precautions could result in personal injury or equipment or property damage.

Clean condensers with an inhibited hydrochloric acid solution. The acid can stain hands and clothing, damage concrete, and, without inhibitor, damage steel. Cover surroundings to guard against splashing. Vapors from vent pipe are not harmful, but take care to prevent liquid from being carried over by the gases.

Warm solution acts faster, but cold solution is just as effective if applied for a longer period.

GRAVITY FLOW METHOD — Do not add solution faster than vent can exhaust the generated gases.

When condenser is full, allow solution to remain overnight, then drain condenser and flush with clean water. Follow acid manufacturer's instructions. See Fig. 16.

FORCED CIRCULATION METHOD — Fully open vent pipe when filling condenser. The vent may be closed when condenser is full and pump is operating. See Fig. 17.

Regulate flow to condenser with a supply line valve. If pump is a nonoverloading type, the valve may be fully closed while pump is running.

For average scale deposit, allow solution to remain in condenser overnight. For heavy scale deposit, allow 24 hours. Drain condenser and flush with clean water. Follow acid manufacturer's instructions.

Checking System Charge — Units are shipped with full operating charge. If recharging is necessary:

1. Insert thermometer bulb in insulating rubber sleeve on liquid line near filter drier. Use a digital thermometer for all temperature measurements. DO NOT use a mercury or dial-type thermometer.
2. Connect pressure gage to discharge line near compressor.
3. After unit conditions have stabilized, read head pressure on discharge line gage.

   NOTE: Operate unit a minimum of 15 minutes before checking charge.
4. From standard field-supplied Pressure-Temperature chart for R-22, find equivalent saturated condensing temperature.
5. Read liquid line temperature on thermometer; then subtract from saturated condensing temperature. The difference equals subcooling temperature.

Refrigerant Charging

⚠ WARNING

To prevent personal injury, wear safety glasses and gloves when handling refrigerant. Do not overcharge system — this can cause compressor flooding.

NOTE: Do not vent or depressurize unit refrigerant to atmosphere. Remove and recover refrigerant following accepted practices.

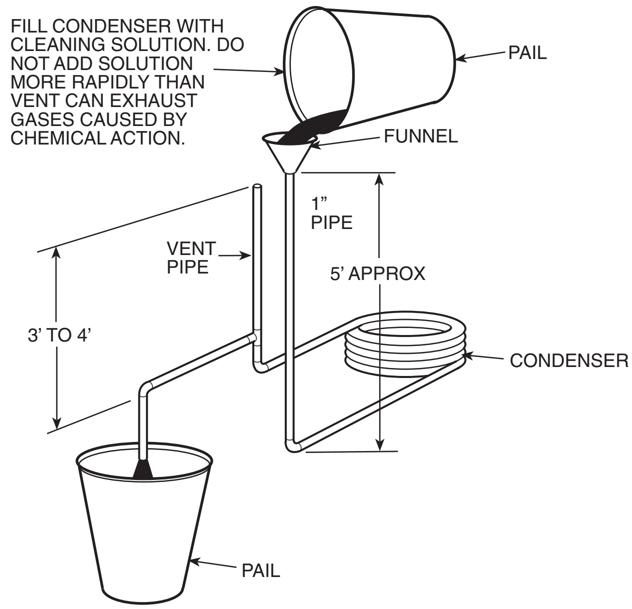


Fig. 16 — Gravity Flow Method

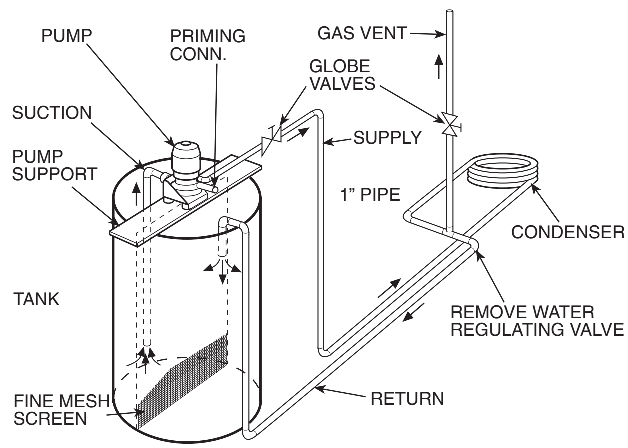


Fig. 17 — Forced Circulation Method

Air Coil Fan Motor Removal

⚠ CAUTION

Before attempting to remove fan motors or motor mounts, place a piece of plywood over evaporator coils to prevent coil damage.

Motor power wires need to be disconnected from motor terminals before motor is removed from unit.

1. Shut off unit main power supply.
2. Loosen bolts on mounting bracket so that fan belt can be removed.
3. Loosen and remove the 2 motor mounting bracket bolts on left side of bracket.
4. Slide motor/bracket assembly to extreme right and lift out through space between fan scroll and side frame. Rest motor on a high platform such as a step ladder. Do not allow motor to hang by its power wires.

TROUBLESHOOTING
(Fig. 18 and 19, and Table 27)

When troubleshooting problems with a WSHP, consider the following:

Thermistor — A thermistor may be required for single-phase units where starting the unit is a problem due to low voltage. See Fig. 18 for thermistor nominal resistance.

Control Sensors — The control system employs 2 nominal 10,000 ohm thermistors (FP1 and FP2) that are used for freeze protection. Be sure FP1 is located in the discharge fluid and FP2 is located in the air discharge. See Fig. 19.

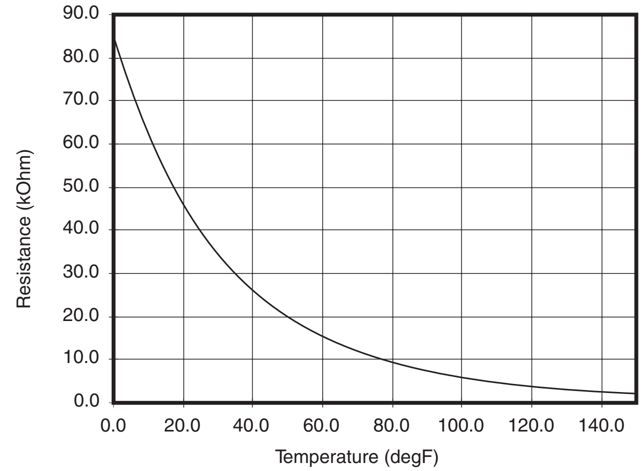


Fig. 18 — Thermistor Nominal Resistance

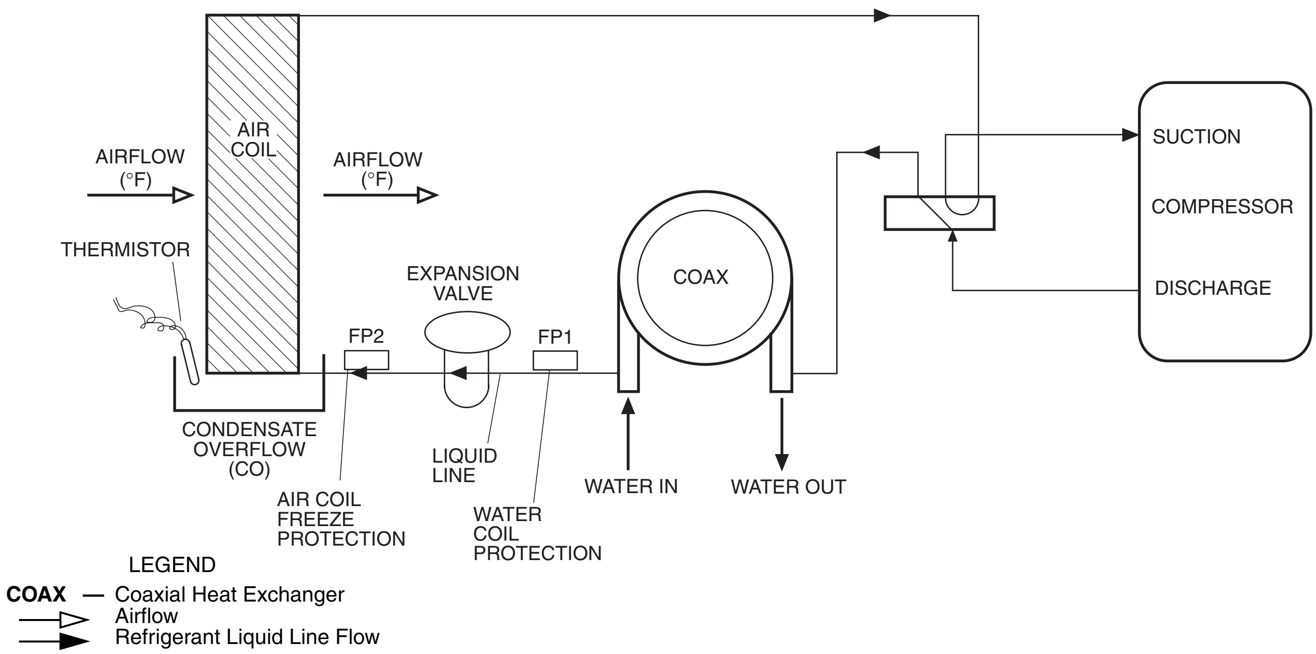


Fig. 19 — FP1 and FP2 Thermistor Location

Table 27 — Troubleshooting

FAULT	HEATING	COOLING	POSSIBLE CAUSE	SOLUTION
Main Power Problems	X	X	Green Status LED Off	Check line voltage circuit breaker and disconnect.
				Check for line voltage between L1 and L2 on the contactor.
				Check for 24 VAC between R and C on controller.
				Check primary/secondary voltage on transformer.
HP Fault — Code 2 High Pressure		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow adjust to proper flow rate.
		X	Water temperature out of range in cooling	Bring water temperature within design parameters.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Dirty air coil — construction dust etc.
				Too high external static. Check Tables 6-16.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition.
	X	X	Bad HP switch	Check switch continuity and operation. Replace.
LP/LOC Fault — Code 3 Low Pressure/Loss of Charge	X	X	Insufficient charge	Check for refrigerant leaks.
	X		Compressor pump down at start-up	Check charge and start-up water flow.
FP1 Fault — Code 4 Water Freeze Protection	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter. Clean or replace.
				Check water flow adjust to proper flow rate.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X		Improper freeze protect setting (30 F vs 10 F)	Clip JW2 jumper for antifreeze (10 F) use.
	X		Water temperature out of range	Bring water temperature within design parameters.
	X	X	Bad thermistor	Check temperature and impedance correlation.
FP2 Fault — Code 5 Air Coil Freeze Protection		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high external static. Check Tables 6-16.
		X	Air temperature out of range	Too much cold vent air. Bring entering air temperature within design parameters.
		X	Improper freeze protect setting (30 F vs 10 F)	Normal airside applications will require 30 F only.
	X	X	Bad thermistor	Check temperature and impedance correlation.
Condensate Fault — Code 6	X	X	Blocked drain	Check for blockage and clean drain.
	X	X	Improper trap	Check trap dimensions and location ahead of vent.
		X	Poor drainage	Check for piping slope away from unit.
				Check slope of unit toward outlet.
				Poor venting. Check vent location.
		X	Moisture on sensor	Check for moisture shorting to air coil.
Over/Under Voltage — Code 7 (Auto Resetting)	X	X	Under voltage	Check power supply and 24 VAC voltage before and during operation.
				Check power supply wire size.
				Check compressor starting.
				Check 24 VAC and unit transformer tap for correct power supply voltage.
	X	X	Over voltage	Check power supply voltage and 24 VAC before and during operation.
				Check 24 VAC and unit transformer tap for correct power supply voltage.
Performance Monitor — Code 8	X		Heating mode FP2>125 F	Check for poor airflow or overcharged unit.
		X	Cooling mode FP1>125 F OR FP2< 40 F	Check for poor water flow or airflow.
No Fault Code Shown	X	X	No compressor operation	See Scroll Compressor Rotation section.
	X	X	Compressor overload	Check and replace if necessary.
	X	X	Control board	Reset power and check operation.
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in 'Test Mode'	Reset power or wait 20 minutes for auto exit.
	X	X	Unit selection	Unit may be oversized for space. Check sizing for actual load of space.
	X	X	Compressor overload	Check and replace if necessary.
Only Fan Runs	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
	X	X	Unit locked out	Check for lockout codes. Reset power.
	X	X	Compressor overload	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check Y and W wiring at heat pump. Jumper Y and R for compressor operation in Test mode.

LEGEND

FP — Freeze Protection
HP — High Pressure
LED — Light Emitting Diode
LP/LOC — Low Pressure/Loss of Charge
RV — Reversing Valve

Table 27 — Troubleshooting (cont)

FAULT	HEATING	COOLING	POSSIBLE CAUSE	SOLUTION
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for line voltage across BR contacts.
				Check fan power enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
	X	X	Thermostat wiring	Check Y and W wiring at heat pump. Jumper Y and R for compressor operation in test mode.
Unit Does Not Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24 VAC on RV coil and at control.
				If RV is stuck, run high pressure up by reducing water flow and while operating engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for 'O' RV setup not 'B'.
		X	Thermostat wiring	Check O wiring at heat pump. Jumper O and R for RV coil.
Insufficient Capacity/ Not Cooling or Heating Properly	X	X	Dirty filter	Replace or clean.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high external static. Check blower Tables 6-16.
		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high external static. Check blower Tables 6-16.
	X	X	Leaky ductwork	Check supply and return air temperatures at the unit and at distant duct registers if significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling.
	X	X	Restricted metering device	Check superheat and subcooling. Replace.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind thermostat.
	X	X	Unit undersized	Recheck loads and sizing check sensible cooling load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform Scaling check and clean if necessary.
	X	X	Inlet water too hot or cold	Check load, loop sizing, loop backfill, ground moisture.
High Head Pressure	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high external static. Check blower Tables 6-16.
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow adjust to proper flow rate.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
	X		Air temperature out of range in heating	Bring return-air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Unit overcharged	Check superheat and subcooling. Reweigh in charge.
	X	X	Non-condensables in system	Evacuate refrigerant, re-charge the system, and then weigh the new refrigerant charge.
	X	X	Restricted metering device	Check superheat and subcooling. Replace.
Low Suction Pressure	X		Reduced water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter. Clean or replace.
				Check water flow adjust to proper flow rate.
	X		Water temperature out of range	Bring water temperature within design parameters.
		X	Reduced airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high external static. Check blower Tables 6-16.
		X	Air temperature out of range	Too much cold vent air. Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.
Low Discharge Air Temperature in Heating	X		Too high airflow	Check blower Tables 6-16.
	X		Poor performance	See 'Insufficient Capacity'.
High Humidity		X	Too high airflow	Check blower Tables 6-16.
		X	Unit oversized	Recheck loads and sizing check sensible cooling load and heat pump capacity.

LEGEND

FP — Freeze Protection
HP — High Pressure
LED — Light Emitting Diode
LP/LOC — Low Pressure/Loss of Charge
RV — Reversing Valve

50HQL,VQL
START-UP CHECKLIST

CUSTOMER:___________________________ JOB NAME: _______________________________________

MODEL NO.:___________________________ SERIAL NO.:____________________ DATE:_________

I. PRE-START-UP

DOES THE UNIT VOLTAGE CORRESPOND WITH THE SUPPLY VOLTAGE AVAILABLE? (Y/N) _______

HAVE THE POWER AND CONTROL WIRING CONNECTIONS BEEN MADE AND TERMINALS TIGHT? (Y/N) _____

HAVE WATER CONNECTIONS BEEN MADE AND IS FLUID AVAILABLE AT HEAT EXCHANGER? (Y/N) _____

HAS PUMP BEEN TURNED ON AND ARE ISOLATION VALVES OPEN? (Y/N) _____

HAS CONDENSATE CONNECTION BEEN MADE AND IS A TRAP INSTALLED? (Y/N) _____

IS AN AIR FILTER INSTALLED? (Y/N) _____

II. START-UP

IS FAN OPERATING WHEN COMPRESSOR OPERATES? (Y/N) _____

IF 3-PHASE SCROLL COMPRESSOR IS PRESENT, VERIFY PROPER ROTATION PER INSTRUCTIONS. (Y/N) _____

UNIT VOLTAGE — COOLING OPERATION

PHASE AB VOLTS _________ PHASE BC VOLTS_________ (if 3 phase) PHASE CA VOLTS_________ (if 3 phase)

PHASE AB AMPS _________ PHASE BC AMPS_________ (if 3 phase) PHASE CA AMPS _________ (if 3 phase)

CONTROL VOLTAGE

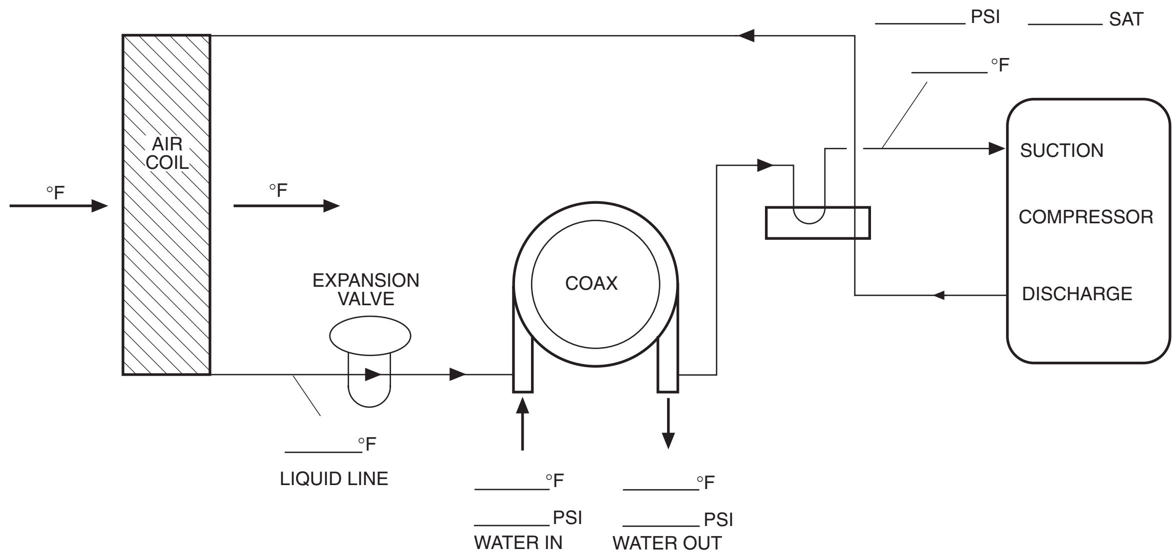
IS CONTROL VOLTAGE ABOVE 21.6 VOLTS? (Y/N) _____.
IF NOT, CHECK FOR PROPER TRANSFORMER CONNECTION.

TEMPERATURES

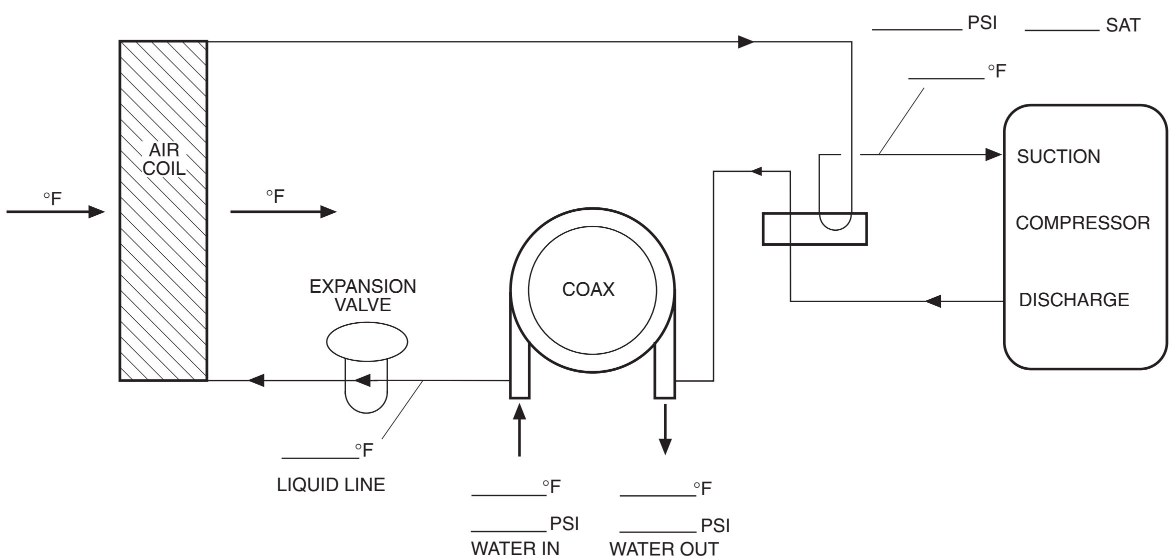
FILL IN THE ANALYSIS CHART ATTACHED.

COAXIAL HEAT EXCHANGER	COOLING CYCLE: FLUID IN	_____	F	FLUID OUT	_____	F	_____	PSI	_____	FLOW
	HEATING CYCLE: FLUID IN	_____	F	FLUID OUT	_____	F	_____	PSI	_____	FLOW
AIR COIL	COOLING CYCLE: AIR IN	_____	F	AIR OUT	_____	F				
	HEATING CYCLE: AIR IN	_____	F	AIR OUT	_____	F				

HEATING CYCLE ANALYSIS



COOLING CYCLE ANALYSIS



HEAT OF EXTRACTION (ABSORPTION) OR HEAT OF REJECTION =

_______ FLOW RATE (GPM) x _______ TEMP. DIFF. (DEG. F) x _______ FLUID FACTOR* = ___________ (Btu/hr)

SUPERHEAT = SUCTION TEMPERATURE – SUCTION SATURATION TEMPERATURE
= ____ (DEG F)

SUBCOOLING = DISCHARGE SATURATION TEMPERATURE – LIQUID LINE TEMPERATURE
= ____ (DEG F)

*Use 500 for water, 485 for antifreeze.

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE